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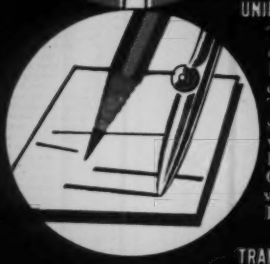

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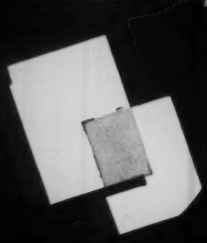

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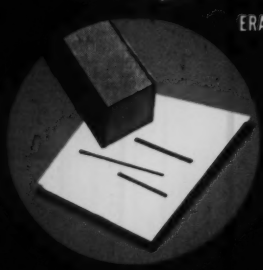

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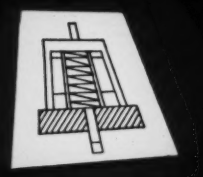

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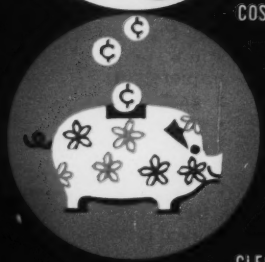

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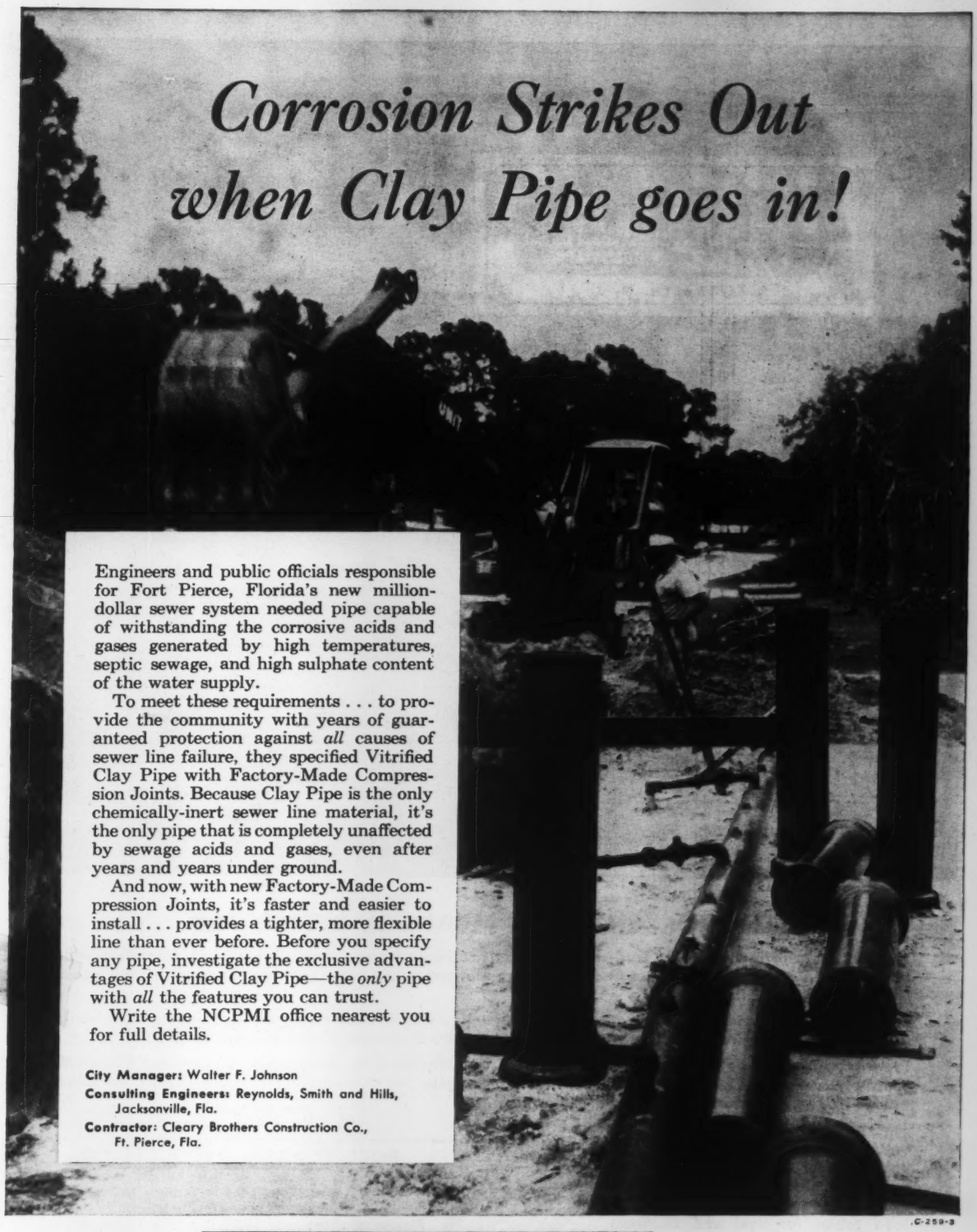

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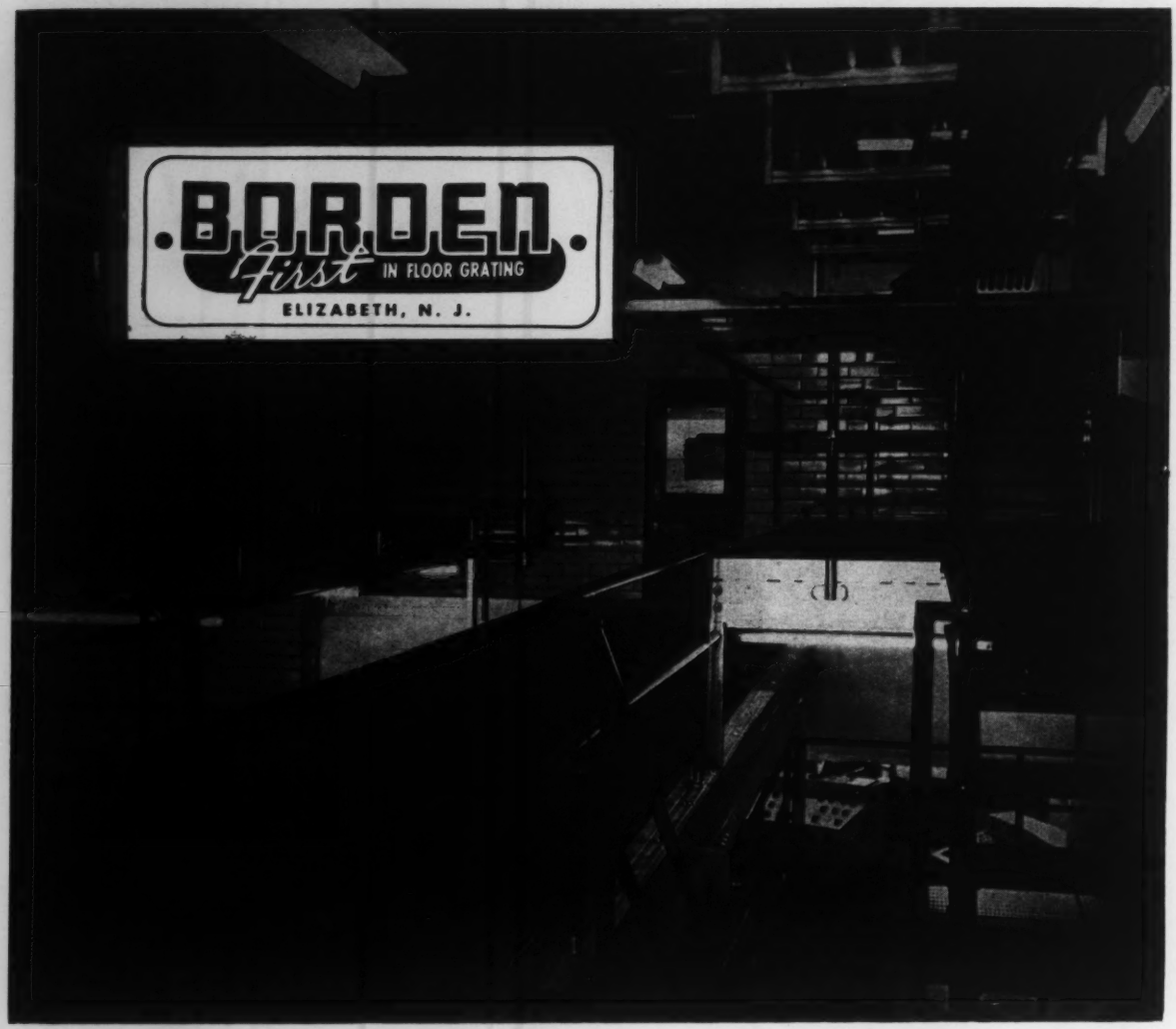

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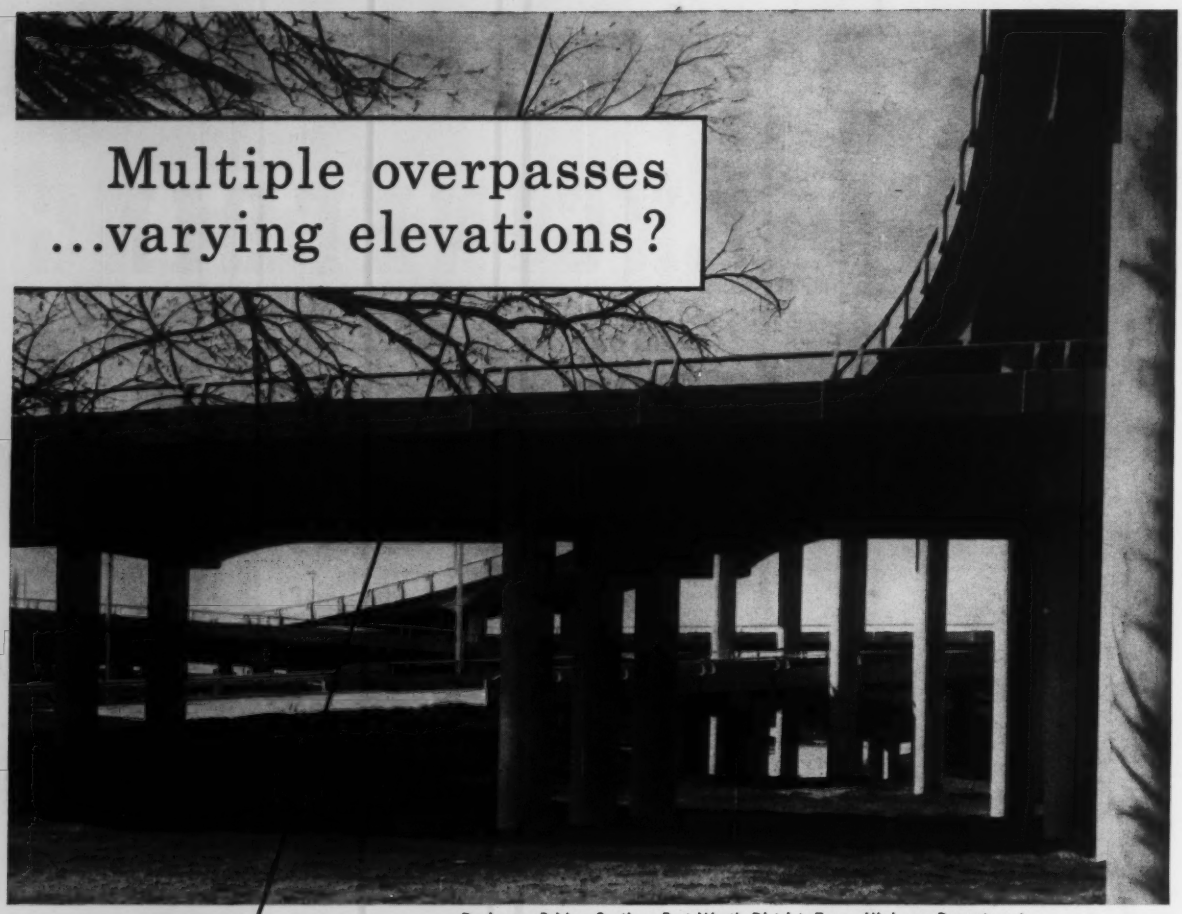

Designer: Bridge Section, Fort Worth District, Texas Highway Department
Contractors: Austin Bridge Company, Dallas; and Worth Construction Company, Fort Worth

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Section of structural steel elevated highway in Denver, connecting north-south Interstate Road with road planned from Denver into Utah. This road to the west crosses the rugged Rockies, requiring an exceptional number of bridges.

In busy Denver area, steel bridge construction provides maximum clearance on short span. Tubular light poles, bridge rails, and sign supports of hot-dipped galvanized steel provide long, maintenance-free service.

Colorado is building 964 miles of Interstate Roads

Workmen assemble steel girders on new 150-foot bridge near Pueblo where railroad crosses U.S. 85-87.

KEEP OUR ROADS ON THE GO

At Colorado Springs, this 393-foot bridge provides quick routing for four lanes of traffic through town on U.S. 85 and 87. Steel reinforcing bars in these tapered piers assure the extra strength needed in this construction.

Colorado's highway engineers devised this efficient non-stop slip-form paver. In one continuous operation, it raises pre-joined strip of welded steel wire fabric to desired height, pours concrete through fabric and over it, levels the surface, forms a perfect edge with the moving edge-guide, and leaves behind an almost completed concrete highway.

with help of USS Highway Products

An impressive sight in Colorado these days is the explosive growth of first-rate roads. The Interstate Highway Program is in full swing. $324,300,000 in federal and state funds is being spent to construct 964 miles of new Interstate Highways and 5,200 new bridges. Already, more than 163 miles have been completed at a cost of about $20,700,000. The 8,433 miles of older roads in Colorado will receive a $2 billion modernization. Plans for the entire program are based on an expected 1975 traffic volume of 6½ million vehicles—over 3 times greater than present loads. This work is under the direction of Joseph J. Marsh, Chairman, Colorado Highway Commission, and Mark U. Watrous, Chief Highway Engineer.

United States Steel makes a complete line of highway products: Structural carbon steel, high-strength and constructional alloy steels for bridges; steel H-piles, sheet piling and tubular piles for bridge foundations; drainage products; cements for all types of concrete construction; slag, reinforcing bars and welded wire fabric; wire rope, cable, tubing and special steels for construction equipment; fence; beam and cable guard-rail, steel for signs . . . and dozens more.

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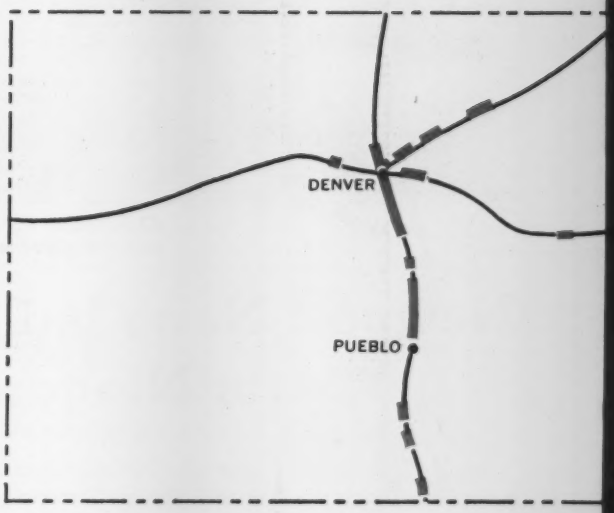

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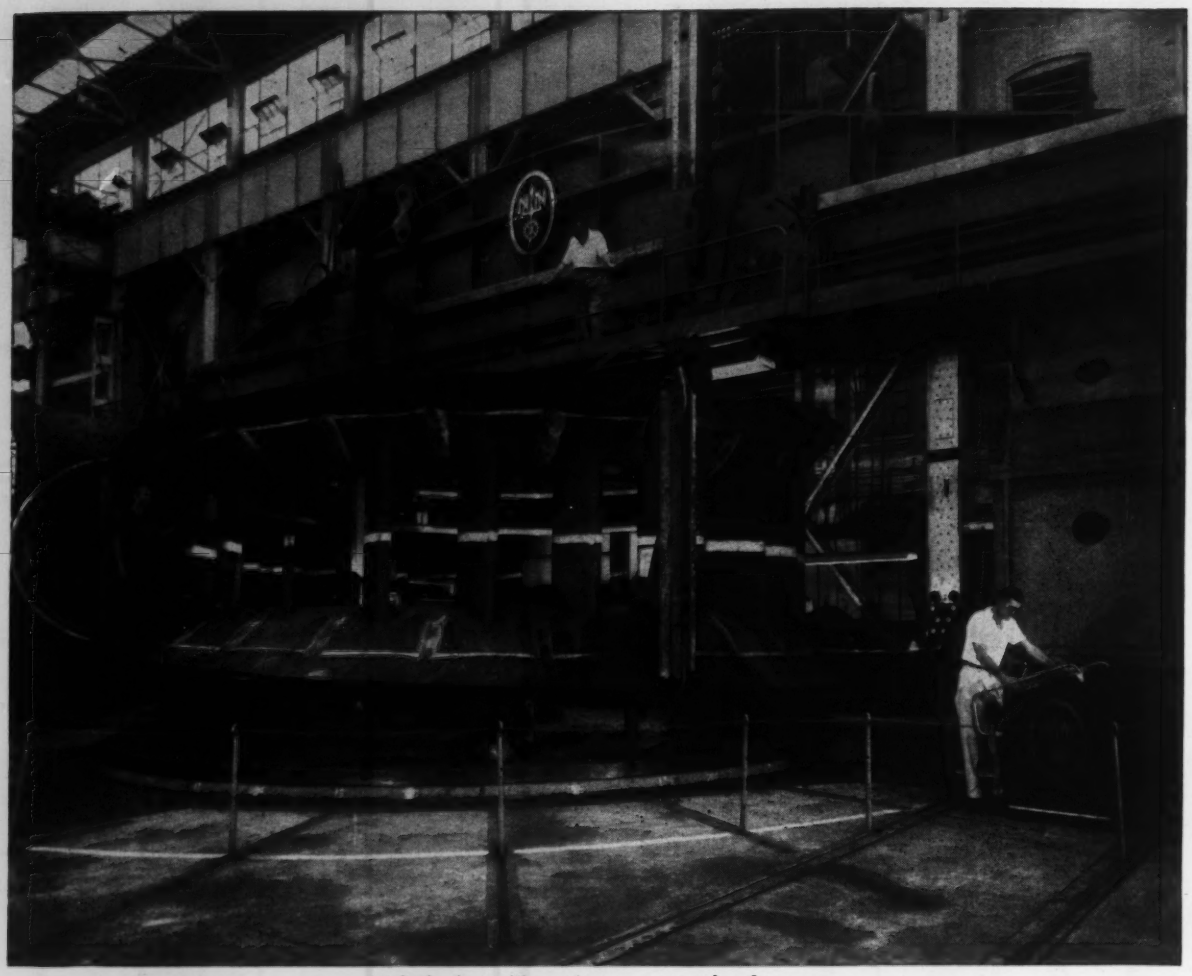
The highway market is served by the following divisions of United States Steel; American Bridge Division, Pittsburgh, Pa.; American Steel & Wire Division and Cyclone Fence Dept., Cleveland, Ohio; Columbia-Geneva Steel Division, San Francisco, Calif.; Consolidated Western Steel Division, Los Angeles, Calif.; National Tube Division, Pittsburgh, Pa.; Tennessee Coal & Iron Division, Fairfield, Ala.; Universal Atlas Cement Division, New York; United States Steel Supply Division, Steel Service Centers, Chicago, Illinois.



42 ft. boring mill-rough cuts a stay ring for one of the world's most powerful hydraulic turbines.

Newport News builds six king-size turbines for Niagara Power Project

These skilled Newport News machinists are milling a stay ring for one of six 200,000 hp. Francis-type hydraulic turbines. Before they're finished, they'll turn out five more turbines—the world's most powerful—for the Lewiston Power Plant of the Niagara Project.

Newport News has not only the men, but the facilities to take a job like this in its stride . . . your job, too. For example, the 42 ft. boring mill pictured above was designed and built at Newport News.

The large engineering and technical staffs, acres of iron, brass and steel foundries, five huge machine shops, and additional specialized equipment make Newport News a leader in the production of hydraulic turbines, valves, gates, penstocks, and other water power equipment you need.

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Installed in 1909 — — Springfield's steel main is still on the job

Things have changed in the waterworks field since '09. But, as the photo shows, even then they were using large-diameter steel pipe in Springfield, Massachusetts.

This 42-in. lockbar steel main carries water some 22,000 ft from Provin Mountain Reservoir in West Springfield across the Connecticut River and into the City. Now in its fiftieth year, it is expected to give many more years of service. And in a half-century it has required very little maintenance.

Another major line, of 54-in. and 48-in. welded steel, with riveted joints, was laid between the reservoir and the city in 1928-1929. It's described as "in excellent shape" today.

The most recent tests indicated the H & W flow coefficients to be 111 for the 1909 line, 140 for the 1928-1929 line, and 143 for another steel line laid in 1949. According to the Municipal Water Works: "These tests showed that steel lines with proper coatings will give very long life as far as carrying capacity is concerned."

Scores of old steel mains are still in service throughout the nation. By present-day standards they were crudely constructed, inadequately protected. If they could give fifty or more years of steady, reliable service, think what today's steel pipe can do—lined and coated with modern coal-tar enamel.

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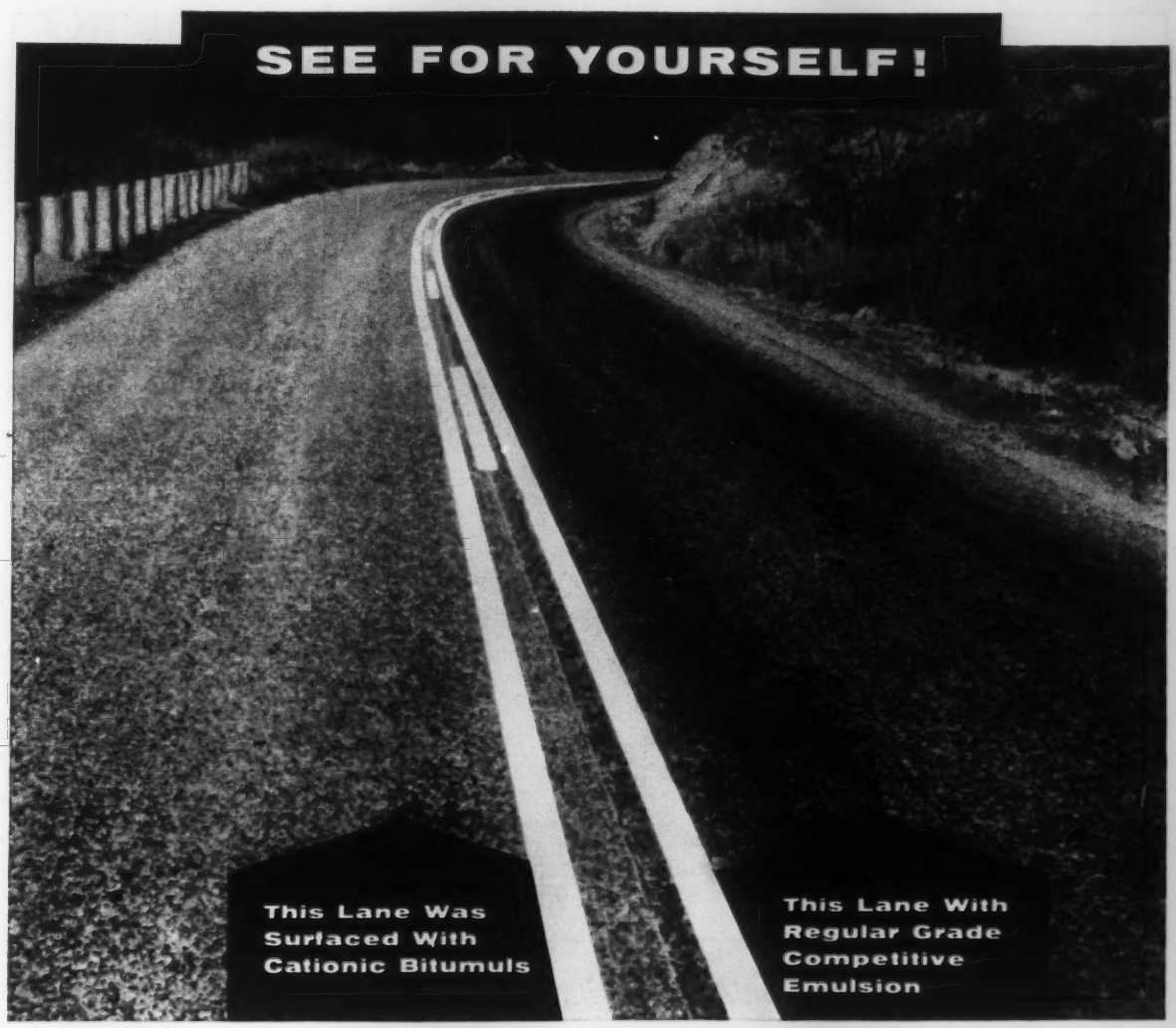

You Get BETTER Surface Treatments With CATIONIC BITUMULS

This photograph gives visible proof of the superior performance of Cationic Bitumuls. The picture was taken on a 25-mile test section of highway in North Carolina.

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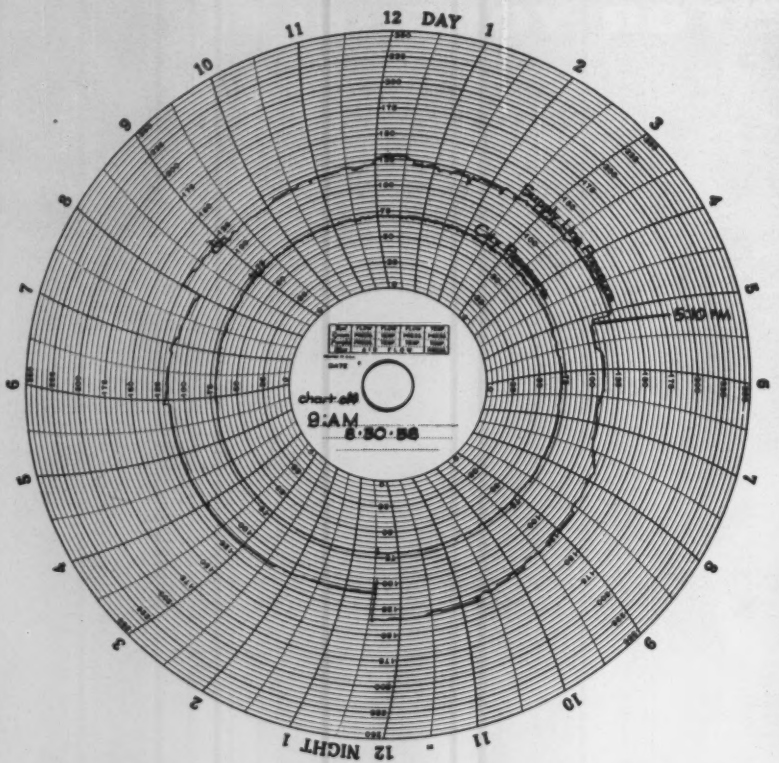

Actual pressure recording meter chart shows how City pressure remains constant despite variations in supply line pressures over a 24-hour period. **EXAMPLE:**

Time	Supply Pressure	Flow Rate	City Pressure
5:00 p.m.	135 psig	8.9 MGD	70 psig
5:10 p.m.	105 psig	15.0 MGD	70 psig

Commissioner Hugh Brewer says: "We are pleased with the continuous, dependable service of these Rotovalves."

"They are the best control valves I ever saw," testifies Water Superintendent John Luce.

Ft. Smith Relies On Allis-Chalmers ROTOVALVES *For*
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Rotovalve is an Allis-Chalmers trade name.

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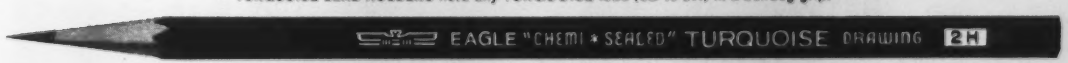

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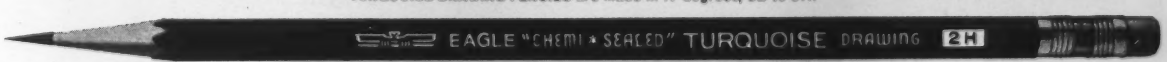

TURQUOISE WITH ERASER, in grades 4B to 6H, is increasingly popular as a field tool.

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So why switch pencils when you switch drafting surfaces? Standardize on Eagle TURQUOISE!

EAGLE

WANT A FREE SAMPLE? Write for a TURQUOISE lead, pencil, or pencil-with-eraser in the degree you'd like to test on your favorite drafting material. Eagle Pencil Company, Danbury, Conn.

$9,000,000 worth of bridges at Forest City and Mobridge, S. D.

Designers: Bridge Division of the South Dakota Department of Highways; Basic design by Bridge Engineer, K. R. Scurr. Final design and details by Missouri River Bridge Section of the Bridge Division, consisting of Roy W. Johnson, Chief Designer, and Structural Designers, Allen Fladeboe and Elek Kirchner.

Resident Engineer: K. O. Long, for foundations

Substructure Contractor: Massman Construction Co., Kansas City, Mo.

Superstructure Contractor: John F. Beasley Co., Chicago, Muskogee, Dallas

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Girder Spans, Mobridge Bridge:
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Biggest bridges between the Mississippi and the West Coast built solidly on USS Steel H-Piles

Bridges span South Dakota's Oahe Reservoir—cost less than estimated

THESE TWO BRIDGES at Forest City and Mobridge are hailed as the largest single engineering and construction projects ever carried on in South Dakota, with the exception of Oahe and Ft. Randall dams. The bridges are larger than any between the Mississippi River and the West Coast.

The Forest City Bridge is 4,583 feet long and the 26-foot roadway is 165 feet above the Missouri River bed. The total cost is approximately $4,715,000.

The Mobridge structure is 5,059 feet long, with a 26-foot roadway 140 feet above the river bed. The approximate cost is $4,471,000.

Both bridges were constructed at costs substantially lower than original estimates. A major factor contributing to maximum economy was an advance purchase by the state of about 5,500 tons of USS Steel H-Piles. The immediate availability of these pilings at the sites had a considerable influence on the bidding for both projects.

At the Forest City site, the 14-inch, 102-lb. USS H-Piles were driven to a maximum depth of 140 feet into Pierre shale using a steam hammer with 30,000 foot-pounds of energy. At the Mobridge site, the maximum length of piling is about 115 feet.

USS Steel H-Piles proved structurally and economically sound

The use of 5,500 tons of USS Steel H-Piles on these projects is further proof of their ability to provide a secure means of supporting foundations in unstable materials. They are readily handled in the field by ordinary equipment, are easy to splice, eliminate jetting, and withstand rough handling.

The great capacity of USS H-Piles for high unit loads, both vertical and horizontal, means fewer piles and fewer driving operations for a given load.

For more detailed information about the lasting safety and economy of USS Steel H-Piles for every type of foundation job, contact our nearest sales office.

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Mobridge and Forest City Bridges are similar in design and together take more than 8 thousand tons of fabricated steel and 5,500 tons of USS H-Piles.

Ultimate strength design used in Philadelphia's newest housing project!

Modern application of this tested principle provides short cuts in planning . . . brings substantial savings in time and materials.

The 18-story Park Towne Place apartments are the largest urban renewal development in the U.S.—and Philadelphia's tallest reinforced concrete structures!

Here was an ideal opportunity for engineers to demonstrate the value of the *ultimate strength method* for designing concrete.

The engineers used *ultimate strength design* because they believed this procedure to be more consistent with actual structural behavior and more realistic in relation to encountered loads, resulting in uniform safety factors—neither over- nor under-designed.

The design of the columns on this project demonstrated dramatically the economy of materials achieved by using *ultimate strength design*. Engineers everywhere are finding *ultimate strength design* is quick and easy when they use procedures, data and design aids now available.

Parke Towne Place Apartments. Architects: John Hans Graham & Associates, Washington, D.C.; Milton Schwartz, AIA, Philadelphia. Structural Engineers: Dorfman & Bloom, Philadelphia. General Contractors: Parkway Triangle Construction Co., Philadelphia.

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Ralph Simmons & Company

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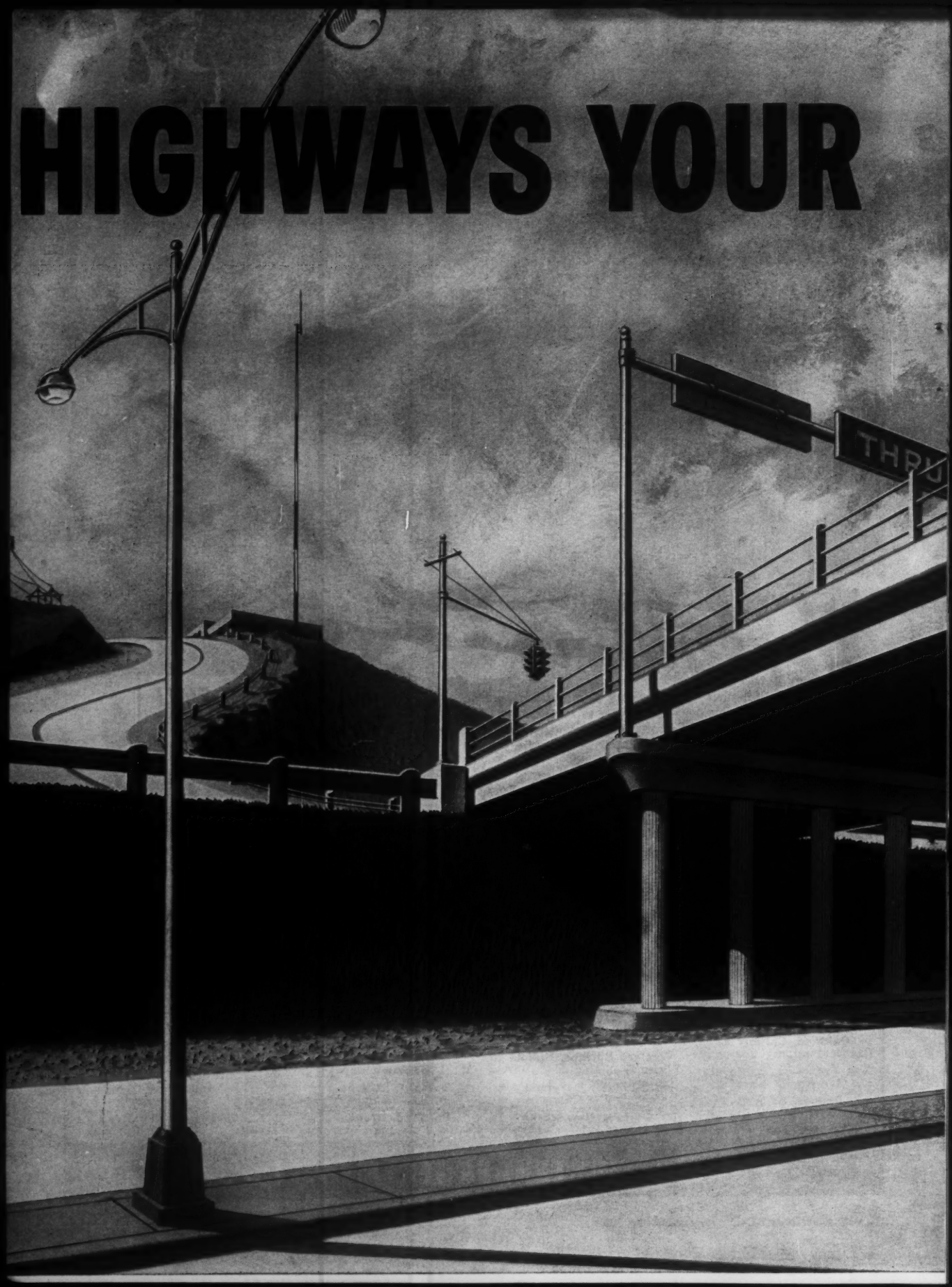
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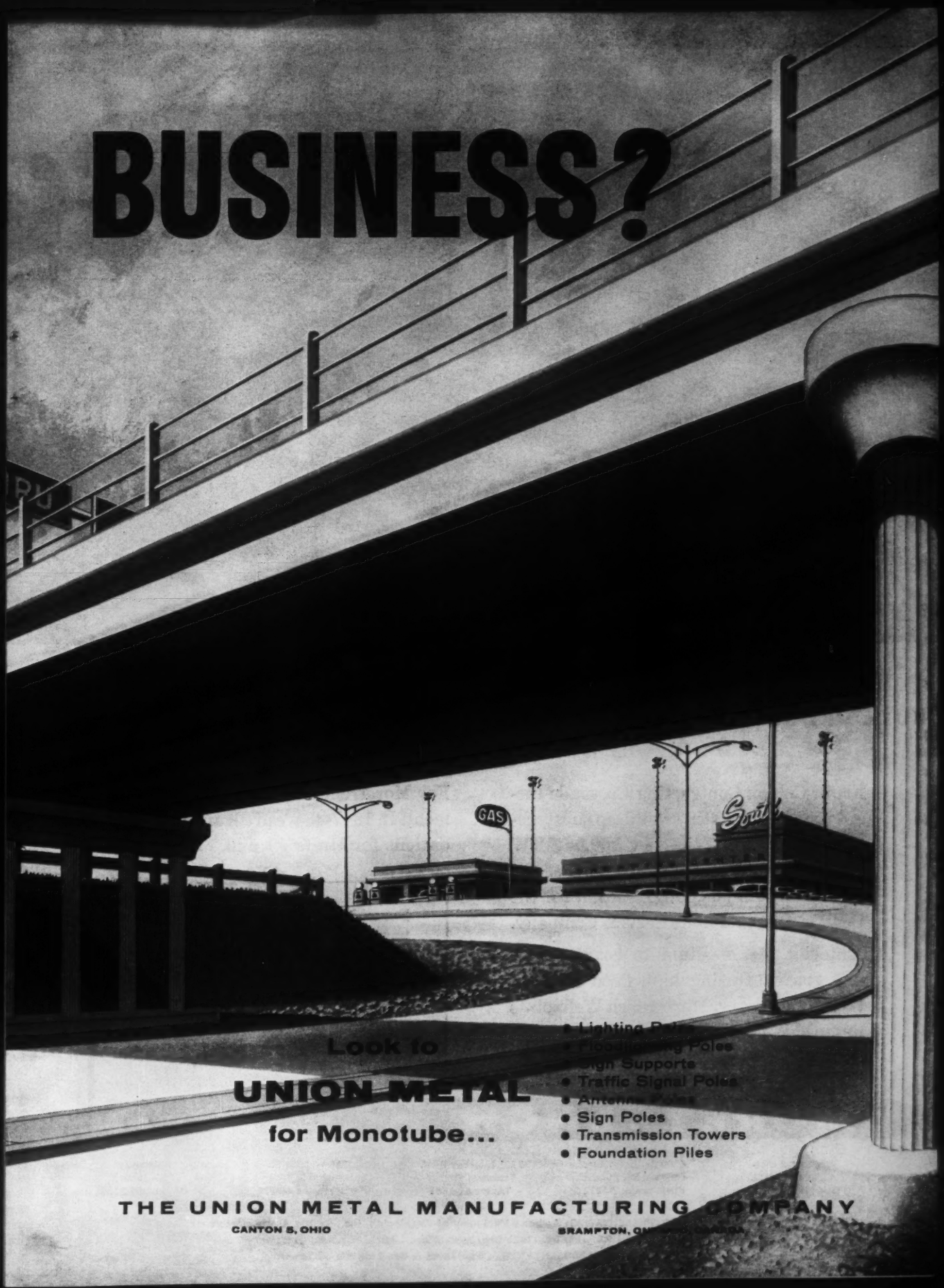
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HIGH RIVER STAGE 433, BONE-DRY SUBGRADE 403. 30′ OF WATER PERFECTLY CONTROLLED BY A MORETRENCH WELLPOINT SYSTEM

Fruin-Colnon Contracting Co. made record time in excavating this deep substructure for Unit #3, the new 200,000 KW turbine generator and boiler unit of the Meredosia, Illinois,power station for the Central Illinois Public Service Company.

Material was medium to coarse sand, and gravel. During high flood stage of the Illinois River, Moretrench Wellpoints pumped 7500 GPM to keep the subgrade dry.

For Moretrench this is a return engagement. In 1947-48 we predrained the foundations for Units #1 and #2.

For nearly thirty-five years contractors all over the world have relied on MORETRENCH for outstanding pumping performance. Take advantage of our years of experience – and top-notch equipment—to get your job going—

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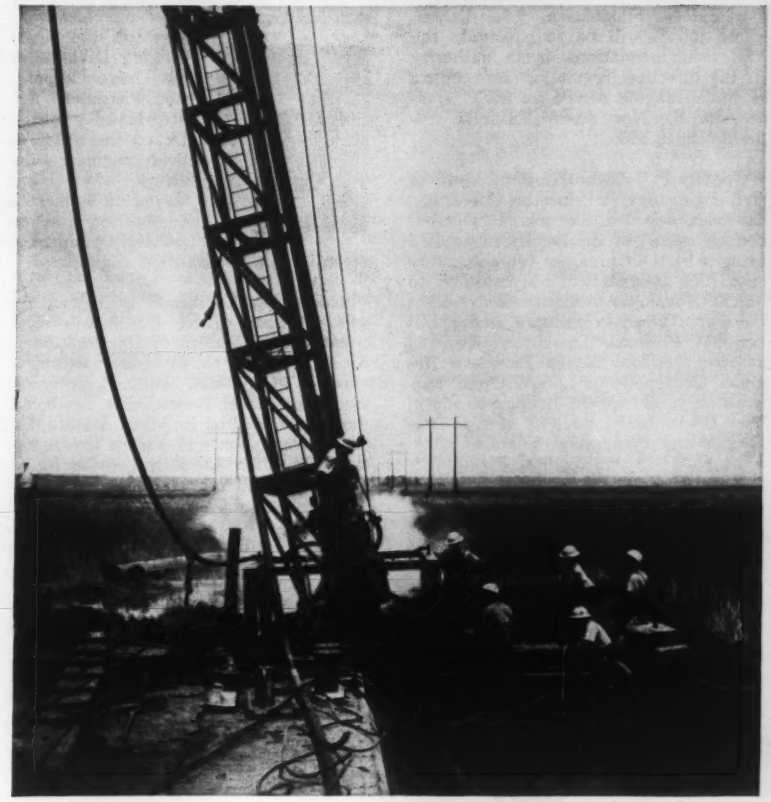
Armco Foundation Piles Support Steel Towers in River Delta Area

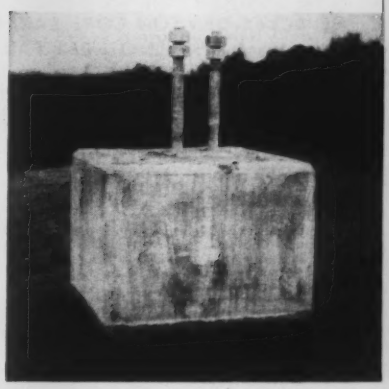


Two of the four Armco Piles can be seen inside this dewatered concrete form. Reinforced rod cages will be inserted in the piles before pouring concrete.

Driving Armco Foundation Piles on a batter, from a barge. Four piles support each pier. Four piers were required for each of the 14 towers.

Engineers: Southern Services, Inc., Birmingham, Alabama
Driving Contractors: Bernard & Byrd, Mobile, Alabama

Close-up of one completed pier of the tower base that encloses four Armco Piles. Tower will be attached to large bolts.



Because of increased demand for electricity in northwest Florida, the Gulf Power Company of Pensacola needed an additional transmission line across two miles of the Escambia River's delta. One of the problems was to provide stable footing for 14 new steel towers, each more than 100 feet high. Armco Foundation Piles helped provide this solution.

Because of the marshy area, the pile driver had to be mounted on a barge. And since piles were designed to be driven on a batter, a special pile template was used to guide and simplify driving. Next, a cofferdam was built around the pier. Then, reinforcing rod cages were dropped to the full length of the piling. Finally, concrete was poured, embedding two large bolts for attachment of the tower leg.

Most of the Armco Piling was 20-inch O.D., driven to an average depth of 46 feet to obtain the 30-ton loading. Piles driven totalled 9,420 feet.

Consider Armco Foundation Piles for *your* next job. Write us for data. Armco Drainage & Metal Products, Inc., 5129 Curtis Street, Middletown, Ohio. In Canada: Guelph, Ontario.

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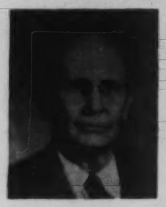
NEWS OF MEMBERS



D. Marshall Haas, a long-time employee of the Humble Oil & Refining Company's Baytown, Tex., refinery, has retired from his position as engineering associate in the firm's Technical Division. For several years, Mr. Haas headed the project engineering group, and in 1952 he became assistant head of the Engineering Division.

James K. Carr, assistant general manager of the Sacramento Municipal Utility District, Sacramento, Calif., has been elected chairman of the California Water Commission. Mr. Carr formerly was an official of the U. S. Bureau of Reclamation in California, and for three years was engineering consultant to the House Interior Committee in Washington.

Edmund R. Ricker has been appointed chief of the newly created Traffic Engineering Bureau of the Pennsylvania Department of Highways in an expansion of the Department's responsibilities following recommendations of the Automotive Safety Foundation. Mr. Ricker, whose job it will be to effectuate the ASF recommendations, is an authority on the direction, regulation and control of traffic, having served as traffic engineer for the New Jersey Turnpike Authority since 1950.

Gregory P. Tschebotarioff, professor of civil engineering at Princeton University, has been awarded the degree "Docteur honoris causa" of the faculty of applied sciences by the Universite Libre de Bruxelles. The insignia will be presented to him in November during the university's 125th anniversary celebration. In September 1958, Professor Tschebotarioff served as vice president of the European Regional Conference on Lateral Earth Pressures organized by the Belgian Group of The International Society of Soil Mechanics and Foundation Engineering.

Reuel F. Pray, III, has been promoted from instructor to assistant professor of civil engineering at Syracuse University. He first joined the faculty of the College of Engineering in 1954 shortly after receiving his master's of civil engineering from Lehigh University.

William A. Robinson has been named assistant general manager and chief engineer of the Contracting Division of the Dravo Corporation, Pittsburgh. Mr. Robinson joined Dravo in 1934 as field engineer and since then has served in numerous engineering and supervisory posts, most recently as assistant chief engineer.

George E. Tomlinson is leaving the post of assistant chief of project development for the Bureau of Reclamation in Washington, D. C., to become executive director of the U.S. Study Commission, Southeast River Basins, with headquarters in the Walton Building, Atlanta, Ga. The Commission was created a year ago by Public Law 85-850 to provide for an integrated and cooperative investigation of a designated 90,000 sq mile area of the Southeast, with the aim of optimum conservation, utilization, and development of both its land and water resources.

William M. McConnell has joined the staff of William J. Connor and Associates of Harvey, Ill., as an architect-engineer and will oversee office and field work. The firm specializes in school buildings and clinics. Before joining William J. Connor and Associates, Mr. McConnell was architect-engineer with the Quaker Oats Company in Chicago.

Benjamin H. Petty, professor of highway engineering at Purdue University, is retiring after thirty-nine years as a member of the civil engineering staff. In addition to his teaching assignments at Purdue, Professor Petty for the past twenty-seven years has edited the School of Civil Engineering's Monthly, "Highway Extension News."

W. E. Harrison on August 1 became assistant manager of the Washington, D. C., office of Armco Drainage and Metal Products, Inc. Mr. Harrison joined Armco Drainage, a subsidiary of the Armco Steel Corporation, in 1945 as Central Division sales engineer and in 1952 was named Indiana State sales manager.

Dave Benham, senior partner in the Benham Engineering Company, consulting engineers of Oklahoma City and Muskogee, Okla., has been appointed by Gov. J. Howard Edmondson to the five-member Oklahoma Board of Engineering Registrations. His appointment is for a five-year term, ending June 1964.

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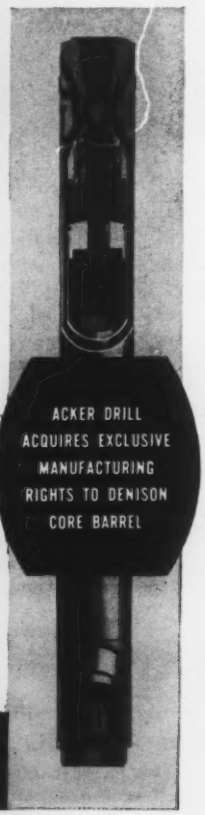

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Bernard L. Werner was appointed director of public works of Baltimore, Md., on July 1. In his new position he will have charge of the ten bureaus comprising the Department of Public Works, including the Bureau of Water Supply which he headed as water engineer for five years. A veteran in the service of the Bureau of Water Supply, he has been associated with the studies, designs, and construction of all the major improvements in the water system, including the Patapsco Development and the Susquehanna River Project currently being developed as a new source of water supply for Baltimore.

Clinton B. F. Brill announces the dissolution of the New York City engineer-architect firm of DeLeuw, Cather & Brill and the formation of the partnership of Brill & Gray to continue the engineering practice of the former partnership at 202 East 44th Street, New York, N. Y. DeLeuw, Cather & Company will maintain an eastern office at 361 Boylston Street, Brookline 46, Mass. The staff of the dissolved firm will continue to function until all outstanding assignments are completed.

Paul Anderson, professor of structural engineering at the University of Minnesota, is now in Korea as educational and technical adviser to Seoul National University.

James E. Amrhein, until recently field engineer in the Long Beach and Orange County (California) areas of the Portland Cement Association, on July 1 took over new duties as a structural specialist in the Association's Los Angeles district office. Prior to joining the Portland Cement Association, he was a structural engineer with the Stone & Webster Engineering Company in Boston, Mass., and with the American Pipe and Construction Company in Oakland, Calif.

V. A. Miller has been named West Coast sales representative of the expanded Advanced Project Department of the Blaw-Knox Company, Pittsburgh, Pa. Mr. Miller goes to Blaw-Knox with a background of thirteen years in the engineering and construction of process and advanced defense facilities, including experience as project manager and engineer on the wartime atomic bomb project.

John J. McFadden, Jr., has been named an associate in Eggers and Higgins, a New York City architectural firm. Mr. McFadden joined the firm in 1949 as chief of the construction division and has been project manager on several major projects including the Mutual Benefit Life Insurance Company Home Office Building, Newark, N. J., and an expansion study for the United States Military Academy at West Point.

Harry Balke, consulting engineer, of Cincinnati, Ohio, announces that his firm, Harry Balke Engineers, has moved into new offices with expanded facilities at 990 Nassau Street, Cincinnati 6, Ohio.

Joseph H. Ehlers, special assistant to the commissioner of the Urban Renewal Administration, Washington, D. C., was one of four men to be made honorary members of the American Institute of Architects at its recent annual meeting. Mr. Ehlers, who is a former Washington representative of ASCE and co-secretary of the Joint ASCE-AIA National Co-operation Committee, was cited "for having signally contributed to the advancement of the profession of architecture by his notable achievement in advancing the professional understanding between architects and engineers."

Frank M. Ikuno, Lieutenant Colonel and assistant post engineer at Fort Ord., Calif., recently retired from the military service. Since entering the service in 1942, he has served as chief of the Legal and Government Section for Shizuoka Prefecture, Honshu, Japan, and as U. S. Army representative for construction liaison with the Japanese Government.

A. A. K. Booth on July 1 assumed the duties of director of the newly formed Division of Special Programs at Rensselaer Polytechnic Institute. Professor Booth has had extensive experience in

(*Continued on page 24*)

Annual Convention of ASCE
Oct. 19-23, 1959
Hotel Statler-Hilton, Washington, D. C.

(*Please print*)

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Mail to:

ASCE Convention Reservations
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Advance Information on Attendance at ASCE Annual Convention

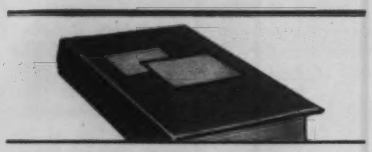
This is not an advance ticket order. Do not send payment. No name is needed.

To: Mr. Eugene F. Baldi
General Chairman
Annual Convention Committee, ASCE
5408 Spring Rd., Bladensburg, Md.

It is my plan to attend to the Annual Convention. I shall have ..... guests attending with me.

During the Convention I plan to attend the following events, tickets for which I shall purchase when I arrive and register:

Function	No. of Tickets
Mon., Oct. 19	
Luncheon	.....
Kickoff Party	.....
Tues., Oct. 20	
Luncheon	.....
Wed., Oct. 21	
Luncheon	.....
Dinner-Dance	.....
Thurs., Oct. 22	
Luncheon	.....
Pan American Fiesta	.....
Fri., Oct. 23	
Luncheon	.....



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News of Members

(Continued from page 23)

industry and education and has been associated with the Institute since 1946 as associate professor and associate chairman of the Extension Education Group. As director of the Division of Special Programs he will administer the Evening Program, the Rensselaer Cooperative Program, the Summer School, special institutes and other cooperative educational programs with industry and government agencies.

Stevenson B. Barnes was awarded the degree of doctor of engineering by his alma mater, Purdue University, in the recent commencement season. In 1933, after ten years as structural engineer with the Los Angeles City Building Department, Mr. Barnes formed his own consulting engineering firm in Los Angeles. Mr. Barnes was appointed by Gov. Godwin Knight to serve on the California State Board of Registration in 1954 and is currently chairman. He is a former vice-president of the Los Angeles Section.

M. H. Cutler, who became engineering manager of the Stone & Webster Engineering Corporation early this year, is

included among the top executives of the firm recently elected vice president. Since joining Stone & Webster in 1923, Mr. Cutler has done design and consulting work on power stations, industrial and chemical plants, and office and commercial buildings throughout the United States and Canada.

Charles E. Cutts, head of the department of civil engineering at Michigan State University, has been chosen by the National Science Foundation to serve as a member of its advisory panel for engineering sciences. The advisory panel assists the Foundation in the evaluation of basic research projects at colleges and universities throughout the nation. Dr. Cutts previously served on the Engineering Facilities Committee.

Harrison D. Comins has accepted the post of associate professor of civil engineering at the University of Missouri. Until recently Professor Comins was assistant professor of civil engineering at the University of Florida, and served as Faculty Adviser for the ASCE Student Chapter there.

Recent additions to the professional personnel on the staff of the U. S. Study Commission—Texas, include **Rolland F. Kaser** as planning engineer in charge of water yield studies; **William Bion Moore** as planning engineer-water use and economics; **Everett W. Rowland** as chief hydrologist; **George E. Townsend** as hydrologist; **Charles S. Stevens** as hydraulic engineer; and **Donald G. Donegan** as engineer.

Walter E. Blessey, newly appointed chairman of the department of civil engineering at Tulane University, returned on September 3 from a five-week lecture tour of 12 cities in 11 Latin American nations, sponsored by the Pan-American Federation of Engineering Societies. The lectures, on mass-produced, precast and prestressed concrete structures in the United States, were well illustrated with slides and included a special colored motion picture on precast construction with Spanish titles.

Hamilton K. Johnson, Major, USAF, recently returned from overseas work on Arctic and Sub-Arctic problems in sanitary and industrial hygiene engineering. His new assignment as chief of the USAF Regional Environmental Health Engineering Services Branch at Kelly Air Force Base, Texas, involves responsibility for twenty-seven states, the United States Air Forces in Europe, and the Caribbean Air Command.

C. M. Gillis has been unanimously voted the new executive director of the Los Angeles Metropolitan Transit Authority by the Authority's board of directors. He has resigned as county road commissioner, a position he had held since last November. Earlier, as state director of public works, Mr. Gillis headed California's highway program.

The Houston Tex. engineering firm of Freese, Nichols, Turner and Collie has announced withdrawal of two Fort Worth members, **Simon W. Freese** and **Marvin C. Nichols. Nat P. Turner** and **Robert M. Collie,** Houston members of the firm, with the entire staff, will continue their engineering practice under the name of Turner and Collie, Consulting Engineers, Inc. The firm's Port Arthur office, in the Adams Building, will continue to operate without change.

George M. Wood has been appointed chief of the Engineering and Construction Branch of the Atomic Energy Commission's Pike County (Ohio) atom plant. Mr. Wood, formerly chief of the Construction Section, joined the Commission in 1952 after more than twenty years as a supervising engineer with the Army Corps of Engineers.

Elmer Lee Anderson retired recently from the St. Louis-San Francisco Railway Company and is now a resident and consulting engineer in Springfield, Mo. Except for approximately two years of army service in World War I, Mr. Anderson had been with the railway company since 1912, as assistant chief engineer and finally chief engineer and assistant to the vice president of operations.

Clifford C. Tabor, formerly manager with the operations services department of the Imperial Irrigation District, Imperial, Calif., has joined the Bechtel Corporation's San Francisco office. As a senior engineer in the hydro division, Mr. Tabor has been assigned to water resources development projects.

Norman James Drustrup, Captain, Civil Engineer Corps, U. S. Navy, has been promoted to the rank of Rear Admiral. He has been District Public Works Officer for the Fourth Naval District at Philadelphia since July 1957, and was previously assistant chief for administration with the Bureau of Yards and Docks.

W. Henry Allison has retired as professor of civil engineering from Clarkson College of Technology after thirty years —eleven of them as chairman of the Department of Civil Engineering. Professor Allison retired from his administrative duties as chairman in 1957. At a farewell testimonial dinner he was hailed by students and associates as a "valued teacher." He is the author of soil laboratory data sheets and other works.

Reed McKinley, since 1947 director of public works for Kansas City, Mo., has been named acting city manager. His association with the city began in 1913 with the Parks Department, but was interrupted by service in World War I and other work. In 1940 he rejoined the municipal service. Mr. McKinley is a past-president of the Kansas City Section.

Martin T. Dyke, head of Land-Air, Inc., a subsidiary of California Eastern Aviation, Inc., was elected president of the parent organization recently. Mr. Dyke, who joined Land-Air in 1954 and was elected president a year and a half later, will continue in both capacities.

Walter J. Emmons, professor of highway engineering, and assistant dean and secretary of the College of Engineering at the University of Michigan, is retiring after thirty-two years service. For the first year he will be on "retirement furlough." Retirement furlough marks the end of regular classroom work and is considered a year of consultantship to the university.

James A. Higgs, who retired several months ago as district sales manager of the American Marietta Company's Concrete Products Division at Atlanta, Ga., recently joined Knoerle, Graef, Bender & Associates, of Baltimore, Md., as an associate. Mr. Higgs is a former Director of ASCE.

Russell E. Horn, formerly executive vice president of Buchart Engineering Corporation, consulting engineers of York, Pa., has been named president. In his new position he will direct and coordinate all engineering activities of the company's operations in highway, bridge, and structural work. Previously he was with the Corps of Engineers and is a Colonel in its reserve force.

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Size Inches	Class 1500	Class 2400	Class 3300	Class 4000	Class 5000
6	1500	2400	3300		
8	1500	2400	3300		
10	1500	2400	3300	4000	5000
12	1500	2400	3300	4000	5000
14	1500	2400	3300	4000	5000
16	1500	2400	3300	4000	5000

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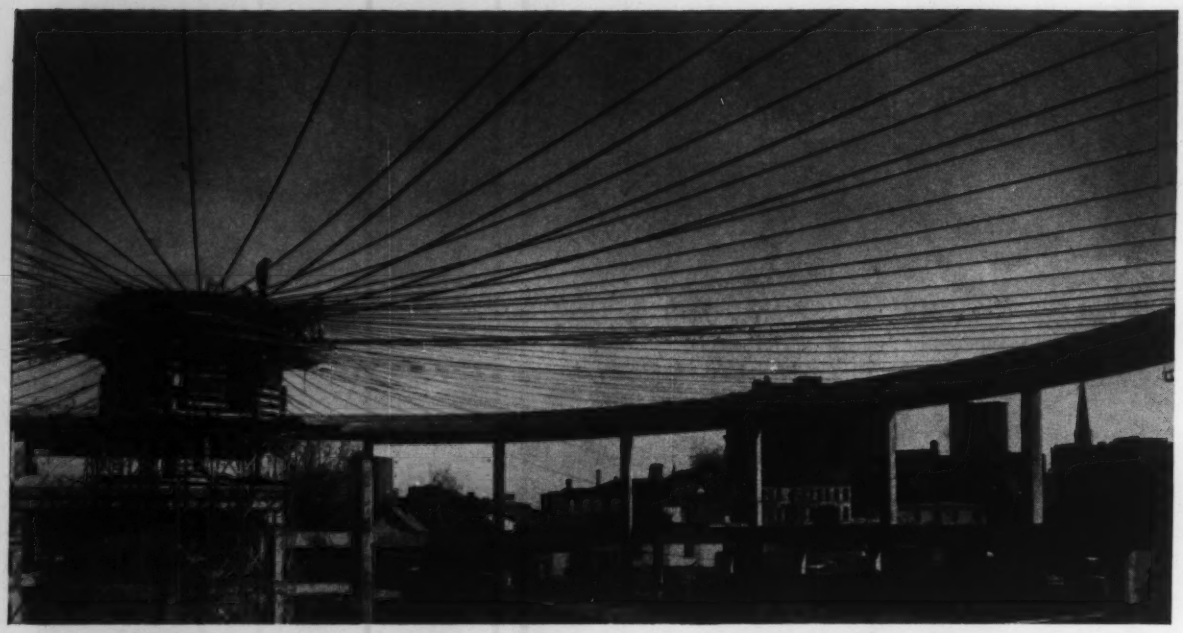

Unique Roebling-Designed Tensioning System used to Erect Suspended Roof Cables of Utica Civic Auditorium

The new Utica Memorial Auditorium at Utica, New York introduces two new principles to the field of suspended roof construction: A double layer of hung cables and a new method for tensioning the cables, devised by John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

Though it is designed in the simplest of all suspension building forms, the double layer cable principle is an exciting departure; each layer being tensioned to a different value.

Aside from furnishing the 72 pairs of cables for the structure, Roebling's role included erection by means of a unique method. Sleeves were accurately placed in the outer concrete compression ring by the General Contractor and after the concrete had cured, an accurate survey was made of the location of all cable connections in the outer concrete ring. The roof cables were prestretched and accurately measured under theoretical dead load stress at the Roebling plant. Thus, the necessity of excessive adjustment on the end connectors and additional adjusting costs at the site were eliminated.

In the finished structure, the two center tension rings are 20 ft. apart vertically. Both these rings were erected on scaffolding to a calculated predetermined erection elevation. The strands were then erected and set to their theoretical final adjustment at the *outer* concrete ring (approximately 2%-3% of their final tension). The scaffolding was then removed from under the center rings after which hydraulic jacks were used to progressively jack apart the upper and lower rings to a distance of 20 ft. This uniformly increased the tension on the 72 upper and the 72 lower roof cables. Vertical stanchions between the upper and lower cables were then installed, further increasing the tension in the cables to that required by the engineers.

Here is an example of Roebling service above and beyond furnishing top quality prestretched galvanized bridge strand. It is a service based on full familiarity and long experience in designing and erecting suspension systems of *all kinds*. This collective knowledge and background is yours for the asking. We welcome inquiries of any nature bearing on suspended roofs or the suspension principle.

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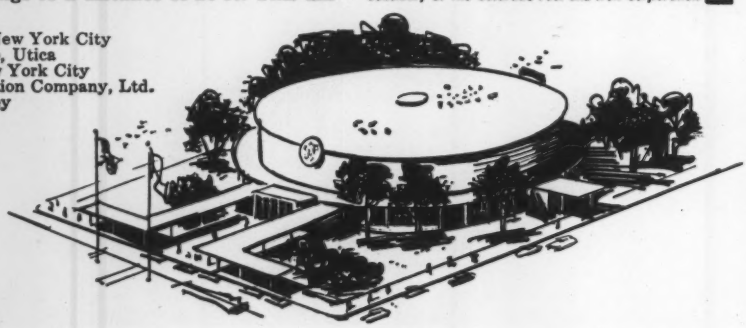
Consulting Engineer: Dr. Lev Zetlin, New York City
Contractors: Sovereign Construction Company, Ltd. Fort Lee, New Jersey



. . . . . Am-Soc Briefs

▶ ▶ Annual Convention suggestion. . . . Be sure to invite interested non-ASCE engineers to the Annual Convention (Washington is the place this year, remember!). All will be welcome on the same basis as members. There is no differentiation in charges for meals, registration, and the like and — more important — non-members may participate fully in all technical session discussion. Pass the program (this issue, pages 65–75) around and invite your associates to attend with you. And tell the younger men in your department that attendance at pertinent sessions is part of their professional education.

▶ ▶ Convention highlights will include four sessions of the Column Research Council — some of them in cooperation with the Structural and Engineering-Mechanics Divisions. . . . Since its organization by ASCE fourteen years ago the Column Council has amassed a wealth of information on the properties of structural materials and the functioning of compression members in different types of structures. The ultimate aim of the program — better, safer structures at lower cost. . . . The Irrigation and Drainage Division is featuring World Wide Irrigation in eleven Convention papers. Written by U. S. engineers, they show the extent to which our consultants, teachers, and engineers in government contribute to welfare around the world.

▶ ▶ Of interest in the drive for funds for the United Engineering Center is a breakdown of pledges in two Sections — the Indiana and the Puerto Rico, both on the UEC Honor Roll. Some 175 of the 287 individual pledges that carried the Indiana Section to its goal came from Associate Members under 40 years of age (page "The Younger Viewpoint"!). In the Puerto Rico Section the story is the exceptionally high percentage of participation, with 128 of the Section's 165 assigned members having made contributions.

▶ ▶ Looking ahead . . . . A five-man committee to handle the 1960 Nuclear Congress (being held in New York in April with ASCE as manager) has been named by Engineers Joint Council, which will coordinate the programs of the 28 participating organizations. Lauchlin M. Currie will be chairman, and Wilbur E. Kelley is the ASCE member.

▶ ▶ Wanted by the Smithsonian Institute. . . . A good clear photo or engraving of Linville's Ohio River Bridge, built at Steubenville in 1864. The Institute is "intensely desirous" of having the photo as part of the civil engineering exhibit being set up in the new wing of the museum. Any reader who can oblige is urged to get in touch with Robert M. Vogel, Curator of Civil Engineering, Smithsonian Institute, Washington 25, D. C.

▶ ▶ Now that we can talk about living on the moon without being thought crazy, the October issue will carry an illuminating article on the engineer's role in making the "self-sustaining civilization" on the moon that will be necessary if man is to conquer space. . . . Other featured articles will tell how the Throgs Neck Bridge is being built across Long Island Sound; how Caracas is coping with the need for more water in a hurry; and how admixtures were used in lining the tunnels of the new Fort Pitt approach to Pittsburgh.

No. 15 • Mars Outstanding Design Series

NO COLUMNS! In an unorthodox application of stress principles to multi-story construction, Architect Seymour Rutkin of New York has eliminated encumbering columns, achieved maximum space flexibility.

His office building of the future is supported by a concrete arch, and unified by circularly wrapped high tension steel cables which also hold the circular concrete floor slabs in compression. At areas of joining both floor slabs and arch are thickened and reinforced in generally three directions to resist moments and rotation about areas of arch support. Concrete is used in compression and steel in tension, as completely as possible. The cylinder in the center of the building is non-structural, acting as a mechanical core for elevators, plumbing, etc.

This ingenious departure from precedent is another example of the contribution today's designers are making. In translating their pace-setting ideas from concept to reality they require the best of drafting tools.

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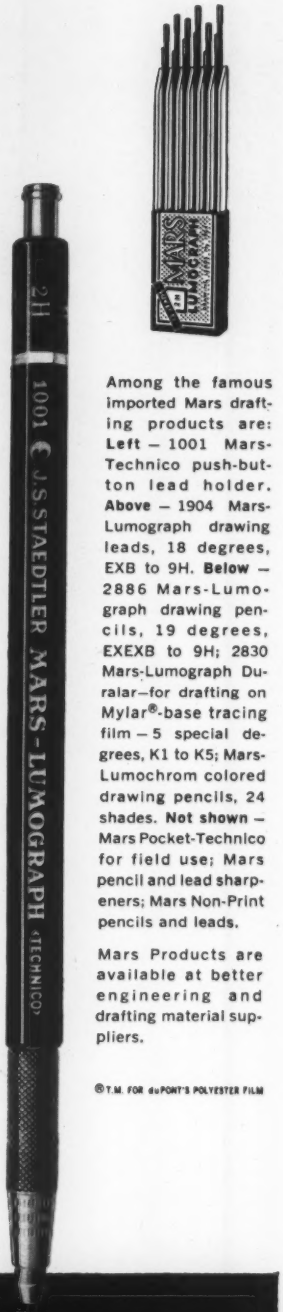

Among the famous imported Mars drafting products are: **Left** – 1001 Mars-Technico push-button lead holder. **Above** – 1904 Mars-Lumograph drawing leads, 18 degrees, EXB to 9H. **Below** – 2886 Mars-Lumograph drawing pencils, 19 degrees, EXEXB to 9H; 2830 Mars-Lumograph Duralar—for drafting on Mylar®-base tracing film – 5 special degrees, K1 to K5; Mars-Lumochrom colored drawing pencils, 24 shades. **Not shown** – Mars Pocket-Technico for field use; Mars pencil and lead sharpeners; Mars Non-Print pencils and leads.

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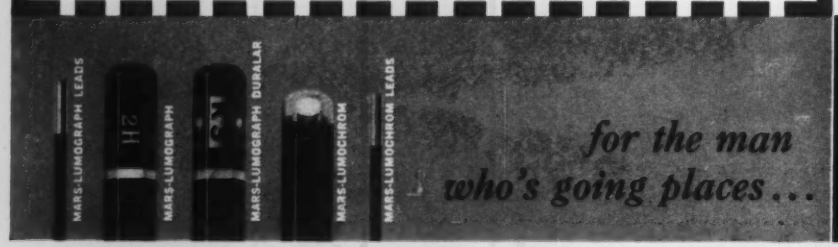

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do you know that

Italy is building the world's highest arch dam? Vajont Dam, now under construction in a deep gorge of the Piave River in northern Italy, will rise 870 ft when completed late in 1960. The narrow dam, built with a double curve, will add 220,000 kw to the generating capacity of the Societa Adriatica di Elettricita, a Venetian firm. Mauvoisin Dam, a 745-ft-high French dam, at present holds the record for high concrete arches. The U.S. record for this type of structure is currently held by Hoover Dam, which is 726 ft high. The world record for high dams goes to Grand Dixence Dam, a 912-ft-high gravity-type structure in the Swiss Alps.

▪ ▪ ▪

New York City is experiencing its greatest construction boom? The process of tearing down old buildings and putting up new ones is proceeding at the fastest pace in city history. Nearly a hundred buildings a week are being demolished. This year alone will see the completion of sixteen office skyscrapers, plus dozens of big apartment houses and public housing projects. For this information our thanks to a recent issue of *Life*.

▪ ▪ ▪

Construction of new schools is not keeping pace with the need? According to the U.S. Office of Education, the nation will be 135,000 classrooms short of meeting even minimum standards this September. The need over the next five years is estimated at 418,200 classrooms, which means a sharp increase in the rate of construction. Financing is seen as the big problem.

▪ ▪ ▪

Foreign steel is cutting into many U.S. markets? Foreign competition against the iron and steel industry of the United States has been increasing since mid-1957, regardless of the status of domestic production, and has been more intense than ever this year. Imports of steel mill products topped exports by more than 77 percent in the first five months of 1959, the first such sustained reversal of the traditional pattern. These figures are reported by the American Iron and Steel Institute. At a recent meeting of the Institute, the Russian steel industry was described as being in "a position to set the competitive pace anywhere in the world."

▪ ▪ ▪

Of significance to gasoline users are two current anniversaries? They are the centennial of the petroleum industry, which had its start in western Pennsylvania in August 1859, and the fortieth anniversary of the first gasoline tax, enacted by the Oregon legislature in 1919. More about motor fuel—the American Road Builders Association estimates that the amount of fuel required to fill a DC-8 jet would last the average car owner over 29 years. By "average" is meant a motorist driving 12,000 miles a year and getting about 15 miles to the gallon.

▪ ▪ ▪

The term "engineer" is still being misused by those who should know better? In a recent article in a national magazine, entitled "Make Words Fit the Job," a writer discussed the effect of label connotations. He said, "Calling a man a sanitary engineer instead of a garbage collector doesn't change his duties, but it does change the way he feels about them." This unfortunate, incorrect, and uninformed choice of words should stir every one of us to do our best to give the public the true picture of the engineer and his work.

▪ ▪ ▪

The AAAS is pushing adoption of the metric system of weights and measures? As a result of action taken at its December 1957 meeting, the American Association for the Advancement of Science is studying the most economic and feasible method of changing over to metric usage and is working with the British Association to further this objective. To clear up the confusion inherent in any such change, the AAAS sponsored an international symposium on the subject at its 1958 meeting and plans a similar program for its December 1959 meeting in Chicago.

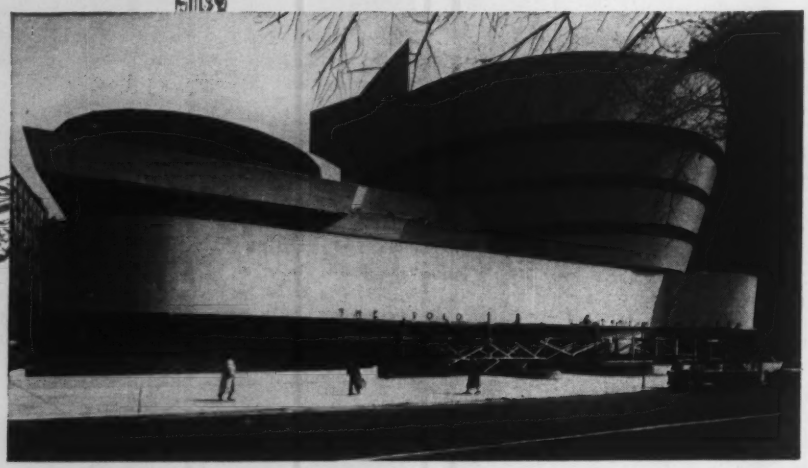
▪ ▪ ▪

The air we breathe is not free? Contrary to popular impression, says Robert D. Smith, Jr., writing on "The Economics of Air Pollution" in a recent issue of *The Arizona Engineer and Scientist*, the cost of a decent breath of fresh air is steadily increasing. In 1949 the annual cost of attempting to control air pollution was estimated at $10 a person by the Stanford University Research Institute. By 1958 the Armour Research Foundation estimated that the cost had gone up to $65 per person per year. The increase is attributed to the growth in population and the expansion in heavy industry.

▪ ▪ ▪

The construction industry is at a virtual standstill in Alaska? This issue carries articles on several important projects in our forty-ninth state. Unfortunately a strike has currently closed down practically all construction projects in the vast area. Important projects shut down until next summer include a military installation for the U.S. Air Force on St. Lawrence Island in the Bering Sea. The stoppage, which Alaska's Governor Egan calls an "economic disaster," centers around a wage dispute between the Alaska Council of Carpenters and the Associated General Contractors.

A Work of Art for Works of Art...



Guggenheim Museum Reflects Superb Craftsmanship in Concrete

● To anyone who appreciates fine craftsmanship in concrete, one fact stands out about Frank Lloyd Wright's Guggenheim Museum in New York: it is a genuine work of structural art which demanded exceptional precision, patience, and perseverance by the contractor. Only great dedication could have solved the many problems that arose during construction, to bring the project to a successful conclusion.

By way of example, here are a few of the complex structural problems:

Item: 8,000 cu. yd. of 3500 psi reinforced lightweight concrete, placed without expansion joints in temperatures as high as 100°F.

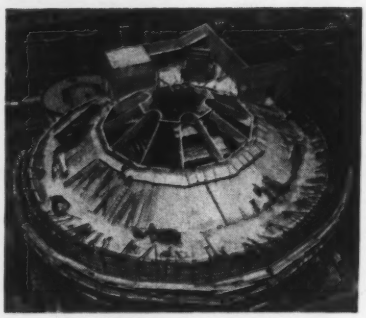
Item: A ½-mile cantilevered concrete ramp that spirals on itself five times at about 3% grade, without columns and with constantly changing inside and outside radii.

Item: A turning, rising, sloping outer wall, formed against plywood sheets angled and twisted into position.

Item: A precast concrete parapet with geometric figures, sprayed with lead, zinc and copper to obtain a bronze patina.

The list of structural innovations is almost endless, and extends to intricate concreting for planting areas and fountains, utility cores and pipe spaces, massive arches and cantilevered balconies. Utter precision in formwork and concreting resulted in smooth surfaces, true curves and sharp corners that are worthy of the greatness of the project, its contents, and its architect.

Lone Star is proud to have supplied all of the portland cement required for this significant structure—a dramatic example of the beauty and limitless versatility of modern concrete in the hands of imaginative designers and skilled, resourceful builders.



Curved roof beams for double glass dome were cast in place 90 feet above ground level.

THE SOLOMON R. GUGGENHEIM MUSEUM
New York, N. Y.
Architect:
FRANK LLOYD WRIGHT
General Contractor:
EUCLID CONTRACTING CORP.
New York, N. Y.
Lone Star Ready Mix Concrete supplied by:
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The ASCE philosophy of engineering unity

This statement, which summarizes and reaffirms the long-standing policies and attitude of the Society with regard to engineering unity, was issued by the Executive Committee of the Board of Direction on August 7, 1959.

Proponents of various ideas and plans relating to unity of the engineering profession are undertaking to advance their views through the local sections of the Founder and other engineering societies. The Board of Direction of ASCE encourages its Local Sections to inform their members regarding these proposals.

It is urged, however, that any formal action of the Sections be taken only after careful consideration of the policies of the Society, which are the result of much thoughtful and deliberate study.

The following summary of ASCE philosophy and policy is provided to clarify any prevailing misunderstandings, and to establish clearly the position of the Society with regard to engineering unity.

1. In ASCE, unity means cooperative effort in the common interest. The Society welcomes the opportunity to work with other organizations in the attack on and solution of common problems. At the same time, ASCE will continue to apply itself to the same activities and problems to advance the special interests of the civil engineer.

A prime example of this philosophy of unity in action is the Model Law for registration of engineers, initiated by ASCE in 1911 and ultimately developed to its present form as the joint product of thirteen societies.

2. The administrative structure for cooperative effort among existing engineering societies is provided in Engineers Joint Council, which includes 14 national, two regional and four state local organizations in its present membership. By this framework any society may participate in the furtherance of the engineering profession on a broad base. Successful collaboration requires only that the member societies lend their aid with sincerity to their mutual benefit and without attempt to advance their individual ambitions.

3. Engineers Joint Council provides the framework for advancement of engineering in all areas, professional as well as technical. In fact, there is no real need for a cooperative organization that would concern itself only with technical activities.

Note that few, if any, technical problems are of primary interest to all engineering societies. It is now customary for two or more societies having overlapping technical functions to hold joint conferences and to form joint committees. These combinations are best limited to those entities having primary interest.

Professional functions, however, such as registration, ethics, codes of practice, education, practical training, public relations, etc., are of common importance to all engineers and they are properly handled in a confederation of societies such as EJC.

4. Two current proposals merit specific comment here: (*a*) the merger of EJC and Engineers Council for Professional Development, and (*b*) the so-called "Functional Plan."

(a) It is considered desirable that ECPD and EJC be merged into a single entity. This coalition preferably would retain the identity of ECPD in so far as the accrediting medium for engineering education is concerned, and would absorb other professional functions of ECPD into the broader base that is provided in EJC.

(b) The "Functional Plan," proposed by AIEE, would assign all joint technical activities to EJC, educational activities to ECPD, and professional activities to the National Society of Professional Engineers. ASCE notes that the Functional Plan takes no position with regard to the establishment or non-establishment in the immediate future of an overall unity organization for the engineering profession.

The Board of Directors of ASCE considers that the professional interest of all engineers can be served more effectively through a unity organization such as EJC than is possible by any one society. Moreover, there appears to be no justification for a general federation of engineering societies to undertake only technical activities.

5. The following policy adopted by the ASCE Board of Direction in October, 1958, will clarify any misunderstanding regarding the desire of ASCE to work with the National Society of Professional Engineers in the advancement of the profession of engineering:

"Recognizing the importance of the National Society of Professional Engineers as a vital and dynamic influence for the advancement of the engineering profession, and envisaging the great contribution to the profession that could result from the participation of that Society in both Engineers Joint Council and Engineers Council for Professional Development, the Board of Direction of the American Society of Civil Engineers would view with high favor the simultaneous affiliation of NSPE with both EJC and ECPD, and hereby expresses the hope that it may have an early opportunity to approve and to welcome such affiliation on an equivalent status with that of each of the five Founder Societies."

In the same manner that ASCE welcomes collaboration with NSPE at the national level, it encourages its 78 Local Sections to join in state and local activities with local units of other societies. This has been done effectively in state and local councils. The principle of "cooperative effort in the common interest" is applicable at any level.

Olympic-size pool at Michigan State

GORDON W. RUDD, President, National Pool Equipment Company, Florence, Ala.

DONALD O. ROSS, Supervising Architect, Michigan State University, East Lansing, Mich.

The Olympic-size outdoor swimming pool recently opened at Michigan State University at East Lansing, Mich., is typical of the engineered construction that goes into recreation today. This pool is 65 ft wide by 165 ft long, with a 50-ft by 60-ft L-shaped wing, at right angles to the main pool, serving as a diving well. Separation of the diving area from the racing and swimming area permits simultaneous diving events, with increased interest for all.

The huge size of the pool at Michigan State University gives a little indication of current interest in swimming pools. The swimming-pool industry has increased in scope from $50 million in 1950 to about $750 million this year. Marketing specialists believe the next decade will see a steadily higher volume of swimming-pool construction each year. In terms of number of pools, about 25,000 were installed by the close of 1950; today there are about 200,000 pools in use; by 1970 this number is expected to exceed 2,000,000. While California and Florida have about half of today's pool installations, the steady increase in pools throughout the country accounts for the growing interest among engineers everywhere in the fundamentals of design, construction and sanitation of swimming pools.

As shown in Fig. 1, the depth of water in Michigan State University's pool increases evenly from 4 ft (the minimum Olympic depth) in the area most remote from the diving well, to 6 ft at the end adjacent to the 16-ft-deep diving well. (In general, the maximum floor slope should be 1 in 20 in areas shallow enough for walking.) Eight racing lanes of the standard 7½-ft width are clearly marked on the long axis of the pool. The diving tower has platforms at the 1, 3, 5, 7½ and 10-meter heights above the water. The 16-ft depth is the minimum acceptable for diving from the 33-ft height.

An unusual feature of this pool is a tunnel surrounding the periphery of the entire wall. This contains the piping for water circulation and the wiring for underwater lights. The tunnel has observation windows that permit coaches to observe swimmers' motions and to comment through underwater speakers. The tunnel connects directly into the mechanical room in an adjacent building, in which are located filters and other water-treating apparatus for this new outside pool as well as for an indoor pool. Three steel doors give access to the tunnel from the deck.

The outdoor-pool piping, filtration and pumping system is designed to put this entire body of water through the filters once in 8 hours. By also utilizing the filters serving the adjacent 400,000-gal indoor pool, the 800,000 gal in the outdoor pool can be filtered on a 6-hour cycle, a requirement for public pools in some states.

The top of the pool is at about the natural ground level. Excavation in the sandy loam was done by a Michigan Payloader, which loaded trucks to haul the material away from the site. The diving area was excavated with walls sloping 1 on 1, a procedure that caused some difficulty when a cloudburst occurred just after the area was prepared for concrete.

Reinforcing for the floor and sloped wall in the diving well is No. 4 (½-in.) deformed bars on 6-in. centers each way, wired at every other cross point. In the swimming area, bars of the same size are spaced 12 in. each way; the reinforcing is placed 2 in. above the bottom of the 6-in.-thick slab.

Transit-mixed 3,000-psi concrete was used. An exceptionally low slump was required to hold the material without forms on the 45-deg walls of the diving well. Concrete was struck off accurately using wood screeds and was wood floated to a rough-textured true surface. Special care was taken to provide a level top edge as a base for the precast concrete units used to form the vertical walls of the pool.

An essential element of swimming pools designed by the National Pool Equipment Company is the prestressed

vertical wall. Precast 12-in. x 2¼-in. x 16-in. interlocking units are used in parallel rows to leave a 5¾-in. space for poured-in-place concrete. In the center of this space, threaded vertical rods are set on 12-in. centers before the base is concreted, and used to hold the stacked precast units in place.

A rigid template was used to accurately position these rods as their hooked lower end was concreted into the bottom slab. The rods, of mild steel, are ⅝ in. in diameter for wall heights up to 6 ft, and ¾ in. for 8 ft, with a rolled thread at the top. The prestressed rods are the principal reinforcing for walls up to 6 ft in height (Fig 2). The horizontal steel consists of ½-in. rods 12 in. on centers throughout. The walls will stand as cantilevers against a water head inside or earth pressure outside.

The first double-course of precast concrete units was set in mortar to provide a means of starting the concrete units exactly level, plumb and straight. Both a level and a straightedge were used. The high spot on the footing was found, and at this point the first row of precast units was started. The mortar mix consisted of 1 part sand to 3 parts cement. No lime was used in this mortar or in the mortar for any other part of the pool. Leaching of the lime causes discoloration in pools.

Mortar was used under the bottom double row of units only, in order to set the first row level and plumb. The higher courses were all laid dry. The precast units were held in place by a flat metal wythe at each course in each block as a spacer. Underwater flood lights, observation windows, and necessary piping extending through the wall of the pool, were installed by cutting the precast units with a cold chisel or a concrete saw. The necessary installed units were placed before concreting of the opening between the double courses of precast units.

As the interlocking wall units were completed, a short piece of 3-in. by 1⅞-in. shipbuilding channel was set over each stress rod, to rest on and hold down the precast units. A hardened steel washer was used against the channel and the nuts tightened to a torque of about 20 lb to secure the precast units firmly. This was continued around the pool to completion of the wall. At this point, the vertical wall was checked and corrected for alignment and plumb on both inside and outside precast units. This could be done easily by loosening a few stress rods and using a short piece of 2-by-4 as a straightedge to tap the wall into alignment.

To stress the rods and the wall, an ordinary torque wrench was used to apply the proper tension. A 20-lb torque

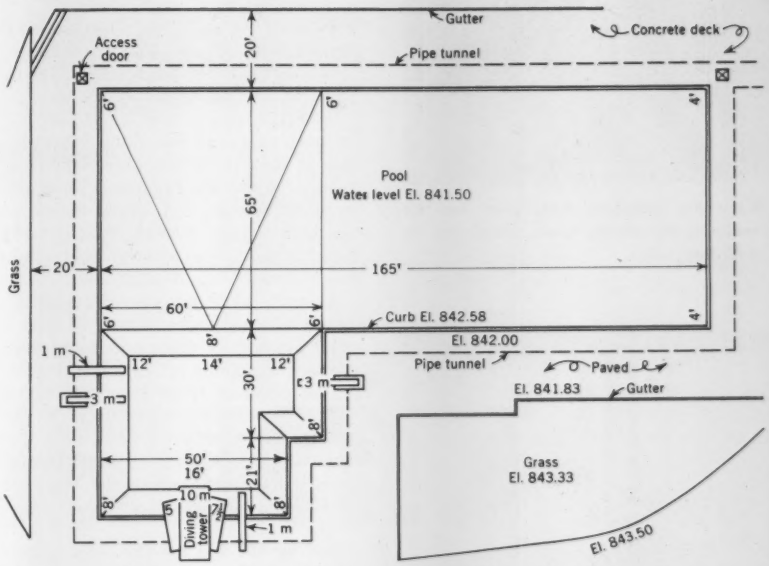


FIG. 1. A diving area outside the racing lanes is a feature of the Olympic-size pool at Michigan State University.

was put on the rods around the pool first; then the torque was increased in stages to the 65-lb level.

The major advantages of the prestressed type of construction used by the National Pool Equipment Co. are: (1) By means of the vertical steel bars, the precast concrete units (or wall) are held under pressure against the floor and footing. This type of construction eliminates the possibility of the wall separating from the floor. (2) The precast units are of 3,000-psi concrete and cured before arrival at the job site. This assures quality concrete for the wall structure and eliminates concrete shrinkage at the site. (3) It also eliminates the need for forms; (4) allows contractors to start several pools concurrently without added capitalization

FIG. 2. Precast concrete units prestressed by mild-steel rods serve as forms for a center section of poured concrete.

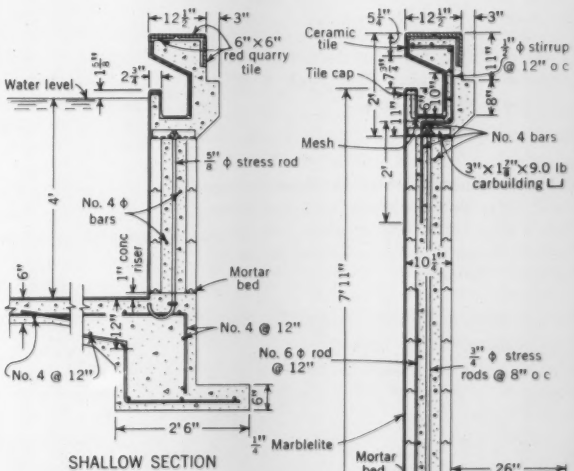
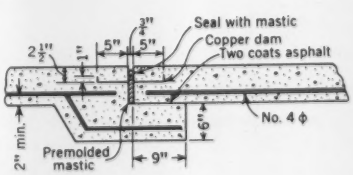
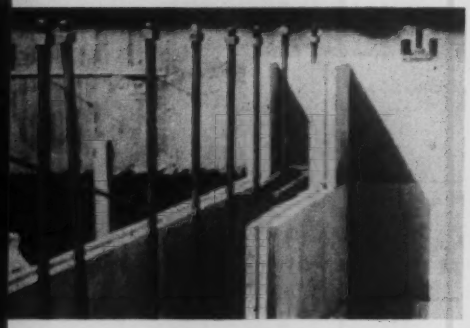


FIG. 3. Detail of a floor expansion joint.



Very dry concrete was used for the walls of the diving area, which are on a 45-deg slope.



Precast units, 12 x 2¼ x 16 in., set 5¾ in. apart, form the walls of the pool.

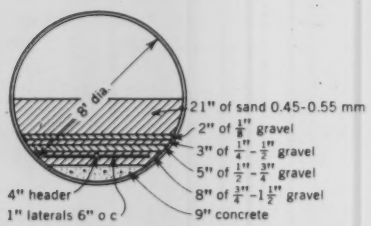
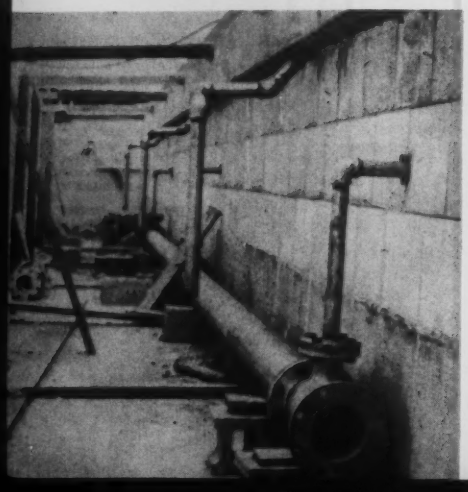


FIG. 4. Filter material is used inside four-cell horizontal steel tank 8 ft in diameter by 32 ft long.

Freshly filtered water in lower pipes will enter pool at many wall locations. Dirty pool water will overflow into scum gutter at top and be collected for return to filter system.



in equipment; and (5) by prestressing the concrete wall and securing it to the floor and footing, adds strength to the structure and eliminates cracking.

With the double row of blocks set, the next operation was filling the center void of the wall with concrete. Pouring was started at one expansion joint and concrete was poured continuously to the next expansion joint. This ensured a monolithic pour without cold joints and resulted in a durable and watertight wall. The concrete mix was designed with sufficient mortar so that a small amount of the paste could seep through the joints of the precast units in the opening formed by the metal wythe. A small electric vibrator was used to assist in filling the joints and eliminate any bridging of the concrete. Concrete for the void in the wall, the gutter, and the bond beam was placed at one time.

Setting the tile for the scum gutter was the finishing touch on the vertical walls. Elevations were checked every 5 ft with an engineer's level to determine the high spot at which to start setting the tile. A cement mortar bed of not less than ¼ in. nor more than ⅞ in. was placed under each piece of tile. Every effort was made to obtain an even setting and alignment, so that a neat and true finish resulted. It has been found for competitive swimming that raising the elevation of the scum gutter 1⅝ in. at the ends of the pool eliminates objectionable back splash and provides a smooth water surface. The new installation at Michigan State has this differential so that most of the excess water splashes out along the side.

Turquoise glazed ceramic tile is used at the top of the gutter to eliminate the water-line stain that would occur on many finished surfaces. This water-line stain is easily removed from the tile. Frost-proof tile was used since this was an outside installation; thus tile soaking was unnecessary. After the tile had set, a mixture of white portland cement and water was used to point all the joints between the tile. This produced a white joint and helped beautify the pool.

Marblelite finish

Marblelite, a finely ground white Georgia marble applied by trowel, is used for the wall and floor finish of the pool at Michigan State University. First, a ¼-in. brown coat was put on over the entire wall surface, leaving the finish fairly rough for the finish coat. The brown-coat mortar consisted of 2½ parts clean plaster sand to 1 part gray portland cement, thoroughly mixed. Again, no lime was used. The surfaces of the concrete wall were wet before the brown coat was applied, to obtain a good bond. The thickness of this coat varied to correct any inequities in the wall surface. The surface was dampened just before the Marblelite was applied.

The Marblelite used was No. 16 and No. 20 grade, thoroughly mixed in equal parts with 1½ part of No. 16 and 1½ part of No. 20 to 1 part white portland cement. The Marblelite is a fairly fast drying material; it was mixed rather wet to allow time for placing. The Marblelite was applied to the walls with a wood float and then finished with a sponge float to obtain a semi-rough finish to prevent slipping. Immediately after the Marblelite was applied, the finished surfaces were sprayed lightly with a hose to prevent drying and possible checking of the finished surface. The pool was filled with water as soon as practicable to facilitate curing under optimum conditions.

The diving tower, 10 meters high (32.8 ft), is a hollow concrete shaft constructed from the same precast 12 x 2¼ x 16-in. units used for the pool walls. The tower is 5 ft 4 in. by 4 ft in section for its full height, with an open center well 3 ft 5½ in. by 2 ft 1½ in. The structure is supported as a cantilever by a double row of No. 6 (¾-in.) reinforcing bars set in the 5¾-in. wall space. Up to the 3-m deck, 100 bars are used, then 64 up to the 7.5-m level, and 48 for the top lift. The 6-ft 7-in. by 15-ft or 18-ft diving platforms cantilever out from the sides of the tower. An 8 x 24-ft platform caps the column at the 10-m height.

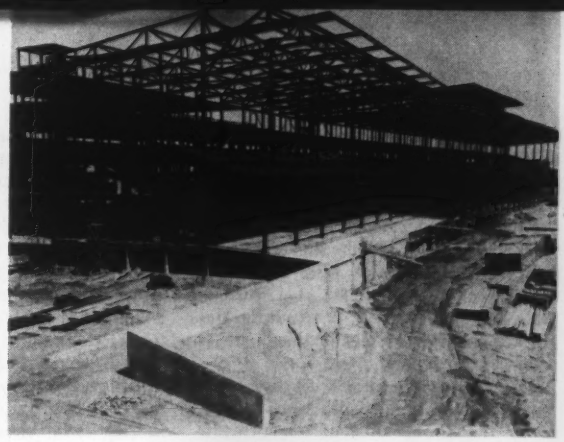
The pipe tunnel was constructed separately after completion of the structural part of the pool. It is 5 ft wide and 6 ft high with a concrete-block wall on the earth side. The top is 4-in. reinforced concrete over corrugated galvanized steel used as a form.

Drainage of the pool is provided by three 12-in. outlets in the bottom of the diving well, piped through a 14-in. line to the filter room in an adjacent building. Hydrostatic relief for an empty pool is provided by 2½-in. strainer units in the underlying gravel bed, piped to valves in the main sumps.

Used water is pumped to one of two 96-in.-diameter, 32-ft-long multi-cell pressure sand filters, designed so that any one of the four cells can be backwashed separately. See Fig. 4.

One Wallace & Tiernan A-751 V-notch chlorinator with a capacity rating of 10 to 200 lb per 24 hours is provided.

Most of the equipment for the pool was supplied by National Pool Equipment Company of Florence, Ala. Precast concrete units were made by a nearby manufacturer under license agreements with National. General contractor for the pool was Pressure Concrete Co. of Florence, Ala.



Seating deck takes up less than half the depth of grandstand structure. See Fig. 2.

AQUEDUCT...

a new race track at an old location

HAROLD V. ROBICHAU, F. ASCE

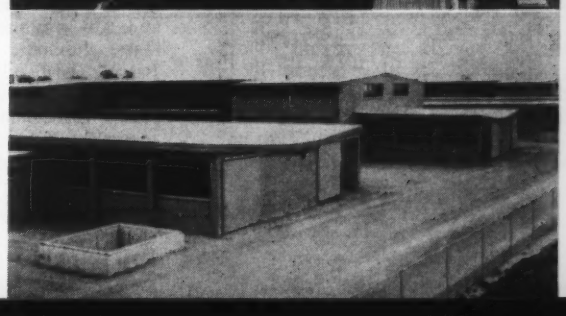
Project Engineer

Stone & Webster Engineering Corporation

Boston, Mass.

Spacious standee ramp extends from grandstand to outer rail of dirt track.

New transit station and approaches are seen from the grandstand. White areas on canopy roofs are marble chips being spread.



In typical view of stables, note second-story portions, used for dormitories.

One of the most elaborate race tracks ever constructed in this country opens to horse racing at Aqueduct in New York City on September 14. It has a new grandstand structure a fifth of a mile long, 350 ft deep and 110 ft in maximum height, which covers 7 acres of ground and has a floor area on four levels of 23 acres, serviced by 18 escalators and 9 elevators. Facilities have been designed for a peak attendance of 75,000 patrons. Parking space is provided for 12,000 automobiles; a new rapid transit station built by the race track for the New York City Transit Authority will handle 30,000 to 40,000 people on a peak day.

The horses also have completely new facilities, starting with 500 stalls designed to prevent spread of fire. The tracks have been entirely rebuilt with three concentric racing strips—a 1⅛-mile dirt track, a 1-mile turf track and a 7-furlong (⅞-mile) steeplechase track, as shown in Fig. 1.

Complete demolition and rebuilding on the 203-acre site started at the close of the 1956 fall track meeting and is now being completed at a cost of $33 million. Established in 1894, Aqueduct Race Track is located near New York International Airport (Idlewild). It is now owned by the New York Racing Association (NYRA) a non-profit organization that also operates Belmont Park and Jamaica in the Metropolitan area, and Saratoga upstate. During the nearly three years that Aqueduct has been out of operation, additional racing dates have been assigned to Belmont and nearby Jamaica.

Grandstand

The grandstand has features of interest to engineers as well as horse players. Unlike conditions on many large projects, foundation material is uniformly good. Firm sand underlies the site, and spread footings are used throughout.

The supporting steel was designed principally as a rigid frame with a minimum of diagonal bracing to obstruct visibility and access. For this work, 8,500 tons of material were erected by the American Bridge Division of U. S. Steel Corporation. Wind shears in most columns are removed at the main-floor level by a reinforced concrete floor, and these forces are transmitted to the ground by numerous concrete shear walls distributed throughout the grandstand area. Upper floors and the seating areas have concrete floors on steel decking. Wind-tunnel tests were run on a model of the seating-deck roof, principally for the purpose of checking the vibration characteristics of this tremendous cantilever sail.

The appearance of the seating-deck roof from the under side is one of the most striking features of the project. For combined reasons of appearance and discouragement of bird roosting, the roof deck was constructed at the lower-chord level of the roof trusses, as indicated in the photographs. Steel roof decking 7½ in. deep, with the flat side down, spans the 30 ft between trusses and conceals them from below, except for the bottom flanges of the bottom chords. The result is to give a virtually unobstructed ceiling area 135 ft wide and over 1,000 ft long.

Typical roof trusses were shop welded in two sections, an 80-ft anchor arm and a 55-ft cantilever. Design depths were limited for ease in shipment. In the shop assembly of welded trusses, which lack connection holes to fix the lengths and positions of members, it is important to adopt procedures that will maintain an accurate truss outline. However, in order to be sure that the ends of the cantilevers could be properly aligned for this long roof, the details provided for horizontal adjustment to the bottom chords of the cantilevers at their supported ends. Jacking pads were shop welded to the truss chords so that the outer ends of the cantilevers could be brought to transit grades by hydraulic jacks working horizontally between the trusses and the columns or intermediate carrying trusses. Shims to the necessary amount were then inserted at the ends of the truss chords. Grades used for this work were compensated for subsequent deflection due to dead load and half the live load.

Exterior walls on the ends and back of the grandstand are mostly made up of painted, precast concrete slabs arranged in panel designs and finished to a coarse texture. Heat-absorbing glass was used in many public areas on exterior walls.

There are three spacious escalator lobbies at the entrances for the general public on the ground-floor level. The ground floor contains principally offices and service areas. The three upper levels are for spectators. There are three 30-ft-wide pedestrian passageways crossing under the entire width of the grandstand, as shown in Fig. 2, and leading by approach stairways directly to the sloped, 170-ft-wide, standee ramp extending for a distance of 1,700 ft along the homestretch.

Ground-floor offices are provided for the NYRA permanent administrative staff, for stewards and judges, for the Jockey Club, for the State Racing Commission and representatives of the New York State Tax Commissioner, for the New York City Police Department, and for the Thoroughbred Racing Protective Bureau. Quarters are included for the jockeys, a 25-bed hospital, and the patrol and protection police force. A darkroom and projection room are provided for the film patrol, which secures and maintains a continuous movie record of every race from six cameras located strategically around the track.

Levels above the ground floor are occupied principally by seating decks, pari-mutuel betting facilities, dining rooms, concessions, lounges and toilet areas. The covered seating decks have 20,000 seats with full view of the races and are subdivided into grandstand seats, clubhouse seats and box seats. Betting is handled by approximately 675 pari-mutuel windows distributed in groups throughout the areas. There is a complete and enclosed system of mezzanine galleries and stairs, and even a

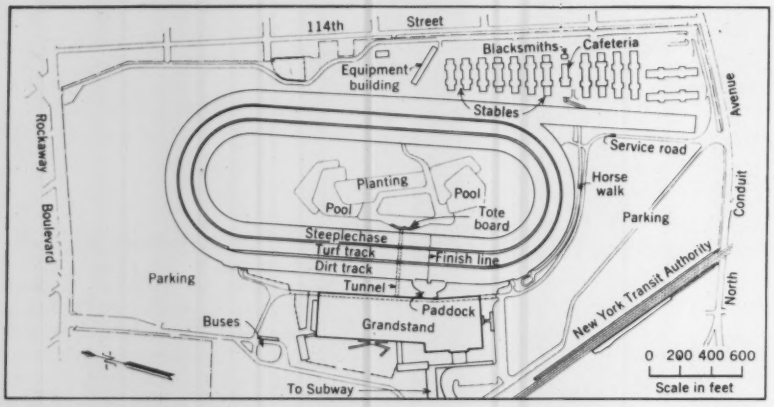


FIG. 1. Plot plan of new Aqueduct Race Track of the New York Racing Association, Inc., near Idlewild Airport.

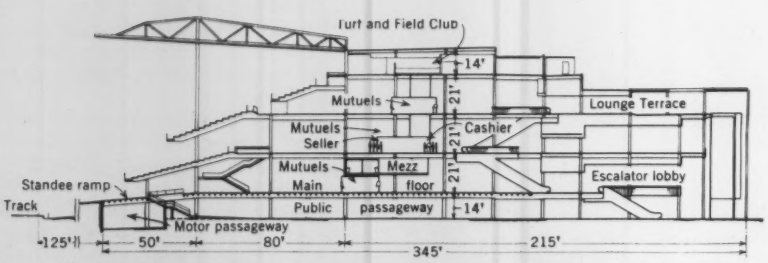


FIG. 2. Generalized cross section through grandstand.

"money elevator" to allow access between these groups and the central totalizator and money rooms on the ground floor.

There are two press boxes at the roof level, one suspended under the roof deck and the other located above. In addition to the extensive facilities for press representatives, these press boxes furnish observer and camera locations for numerous other services.

Handling complicated details of the pari-mutuel system involves a large amount of electrical equipment and a corresponding staff to digest complexities of the betting and quickly convert them to odds and payoffs. The first floor contains an appreciable area for the central quarters of this system.

Catering to the appetites of the patrons poses a major problem. The ground floor houses a general preparation kitchen for this service and an employees' dining room, as well as store rooms and refrigerated rooms for large quantities of foods and supplies. Serving facilities are distributed throughout the grandstand.

Air conditioning is supplied for eating areas, ground floor offices and some other areas. There are 90 toilet rooms at various levels. The mechanical facilities involve 30 miles of piping, 1,000 plumbing fixtures, 22 air conditioning systems, 17 ventilation supply systems, and 98 exhaust-fan units.

Electrical requirements are served by a Consolidated Edison Company network substation located on the east side of the property. From this substation 4,160-v cable feeders extend underground to the ground floor of the grandstand, where four 1,000-kva unit substations reduce the primary voltage to 480/277 v for distribution. Feeders also extend to smaller unit substations in a vault under the tote board, and to the stable area. Over 300 miles of wiring was required for the electrical installation. A gas-engine generator will provide emergency lighting on limited circuits.

Fluorescent lighting at 277 v is used in betting areas, public passageways, offices and shops, the rest of the lighting being mostly incandescent. Mercury high-bay units are mounted under the seating-deck roof for cleanup lighting after racing. Parking areas have units of four 1,000-w mercury lamps in wide light reflectors mounted on 50-ft aluminum poles spaced 400 ft on centers for lighting during late fall meets, when departure extends into the twilight.

New racing strips

The three racing strips are built one inside the other. The southerly extension of the dirt track, visible on the plot plan, is a one-mile chute that permits running of races up to one mile in length with a single turn.

The dirt track has a foundation 14 in. thick, built up in 3- to 4-in. layers, leveled and rolled separately. Material from the old track was carefully preserved and reused but additional material was required. The foundation material turned out to be a clayey sand that compacts into a firm track base.

The top cushion is a special mixture developed by the track operating staff over the years and is applied in a 3-in. layer. The dirt track is 100 ft wide in the homestretch, 110 ft in the chute and narrows to 80 ft in the middle of the turns. The turns are banked for a speed of 30 miles per hour and are introduced by easement curves from the straightaways.

J. S. Watkins, F. ASCE, consulting engineer of Lexington, Ky., and L. E. Gregg & Associates, soil specialists, were retained to insure that the texture and uniformity of the Aqueduct track would be of the same type as other NYRA tracks.

The turf and steeplechase tracks are both grass tracks, having a 2-in. layer of salt hay under 6 to 8 in. of loam. The hay will act as a sponge and hold moisture up to a certain point, but in times of heavy rainfall, any excess moisture will pass down to the sandy soil below and prevent the tracks from becoming soggy. Construction work on the new tracks was started in the early summer of 1957 so that, by the spring of 1958, the grass tracks and infield were planted to rye. In the late summer of 1958, the rye was turned in and the tracks regraded and reseeded to permanent grass. By opening day on September 14, 1959, the turf will be well established.

Track rails for the dirt track are of extruded aluminum sections on steel posts set in concrete. These are used as electrical raceways for teletimer, phone and power circuits running around the track, but the number of underground duct sections to cross required openings in the rail became so numerous that there may not have been any saving realized by this feature.

There is an outdoor paddock in front of the grandstand at the finish line so that, in fair weather, horses will be saddled in full view of the seating area. Foul-weather saddling stalls are located under an overhang of the standee ramp at the same spot.

Stable area

The stable area has accommodations for 500 horses in 13 stable buildings. Three of the stables have second-floor dormitories, which provide sleeping accommodations for 150 stable-area employees. A blacksmith shop, a cafeteria and recreation building, and a maintenance building complete the stable-area group.

Stable buildings are of concrete-block construction with precast-concrete roof framing and slabs. A photograph shows that these buildings are constructed with what has become known as "butterfly" roofs. This construction is the result of an experimental program undertaken a few years ago to develop a type of building that would minimize fire hazards. There are two rows of stalls back to back lengthwise of the building, and separated by a continuous fire wall, which seals against the low center-line of the roof. An interior horse walk runs along the front of the stalls on each side at locations marked by the sliding end doors in the photograph.

The stalls are separated by masonry sidewalls to the roof. However, the front walls of the stalls do not seal against the roof so that, in case a fire occurs in the straw bedding of a stall, the smoke and hot gases can follow the upward pitch of the roof over the front wall of the stall, cross the horse walk, and vent to the outside through continuous openings provided along the eaves. This will not protect the horse in the stall where the fire starts but, by confining the smoke and hot gases and providing for their normal escape to the outside, it is possible to prevent a fire from spreading.

The $33 million cost of the new Aqueduct track includes such items as $1,000,000 for elevators and escalators, $4,000,000 for structural steel and iron, over $2,500,000 for the stable area, $1,000,000, for the new rapid transit station, and $600,000 for landscaping.

With no foundation problems and the structural problem confined mainly to that of size, contacts with people became a big part of the project. There are 12 prime contractors on the project and 70 subcontractors. Somewhat unusual is the multiplicity of governmental and service agencies involved. Eleven federal, state and municipal organizations had an interest, including the Federal Aviation Administration because the grandstand is on a flight path. Eighteen organizations supply utilities and other services to the track.

Stone & Webster Engineering Corporation was retained by NYRA as the project manager on the design and construction of this work. H. N. McCampbell, Vice President, is in general charge, with R. H. Foss as Project Manager for construction, and the writer as Project Engineer. Architectural design was handled by Arthur Froehlich & Associates, with R. J. Krause in direct charge. Andrews & Clark served as consulting traffic engineers, and Innocenti & Webel as consultants on landscaping.

Marina...

AT ATLANTIC CITY

JAMES K. RANKIN, M. ASCE

Chief Engineer, Navigation Bureau

Department of Conservation and Economic Development

State of New Jersey, Trenton, N. J.

Atlantic City's marina, now partly completed, is the newest addition to the city's popular port area. At its present stage of construction, the marina has 220 boat berths, or about half of its planned capacity. Whether inbound from the ocean or from the coastal waterways, boatmen find a haven equipped with facilities in harmony with the needs of modern America afloat.

Owned and operated by the State of New Jersey, the marina at Atlantic City occupies a 21-acre basin dredged out of Clam Creek to a minimum depth of 9 ft below local mean low water. Clam Creek is a tributary of the Absecon Inlet on the northern end of the island on which Atlantic City is situated. A government-maintained channel provides unobstructed access to the Atlantic Ocean, and only a single bascule bridge lies between the basin and the Inland Waterway. Many marinas, modern in every other respect, require that one or more movable bridges be opened to permit passage of boats to the sea, a cause of frequent traffic jams.

Sensing the need for moorings for large numbers of pleasure craft, particularly transients, Atlantic City deeded the marina site to the state in 1941 for the development of a marina as a joint venture. The property was the last unoccupied frontage on Clam Creek and extended 1,750 ft along the north side of the Creek. It consists of about 25 acres of upland and 15 acres of dredged harbor area.

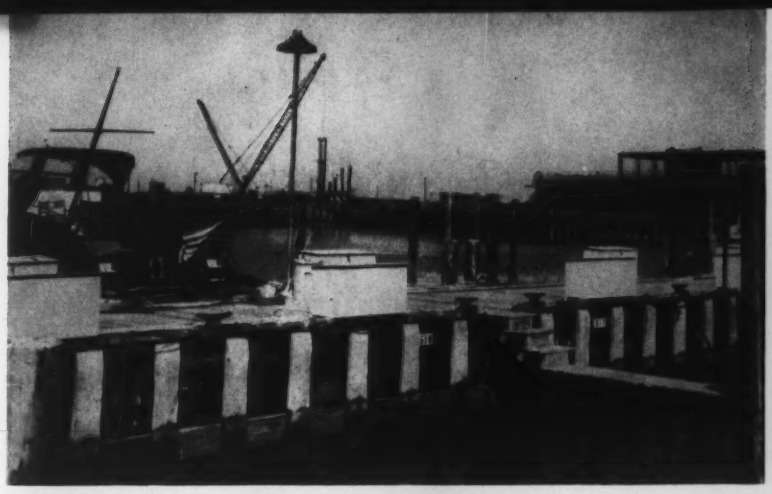
The site is well adapted for a marina and offers natural protection from the ocean. No breakwaters were necessary. Another advantage of the site is the tide action, which flushes the basin twice every day. Since 4-ft tides prevail in the area, the problem of pollution, which is serious at many marinas, is not present at Atlantic City. As the normal maximum tide is only 6 ft, the entire installation is fixed and there is no need for floats.

Atlantic City's famous boardwalk, beaches, hotels, stores and recreation spots are conveniently reached via Maryland Avenue or Brigantine Boulevard, which are at the west end of the marina. Brigantine Boulevard also connects directly to Highway U.S. 40, the Garden State Parkway, and the Atlantic City Airport.

The first construction work done was the 1942 dredging of the rectangular 700 by 1,500-ft basin parallel to the access street, Huron Avenue. Depths of 9 to 15 ft below local mean low water were provided at a cost of $75,600. These depths were in accord with the pier pattern planned at that time. When work was resumed after World War II, it was found necessary to modify the original concepts, but the depths available were suitable, particularly in providing a maintenance margin. The dredged material was used to raise the elevation of adjacent city property in readiness for its use as a marina parking area.

Renewed planning in 1953 was inspired by the burgeoning boom in boating and the enactment of a state statute setting forth legislative policy guidance. The statute established the principle

This early photograph of the Atlantic City marina shows its sheltered location with respect to the ocean, left and top. Piers 7 and 8 have since been built at the left end of the basin. Administration building and parking lot can be seen in foreground.



Catwalks extend out from both sides of the piers. Lighting, electrical outlets, storage lockers, and fire extinguishers are among the services provided on each pier. Fender planks along sides of pier protect boats from the creosoted timbers and piles. Vertical strips on the piles serve the same purpose.

that the state would bear half the cost of constructing a marina provided the municipality contributed the site and the remainder of the construction funds.

After a consideration of several pier patterns, it was decided that finger piers 300 to 400 ft long, with individual berths normal to the piers, would best utilize the basin area and complement development of the upland property. Each berth would have a step-down catwalk for easy boarding by all members of the family.

Previous experience with other state-operated marinas—at Leonardo on Sandy Hook Bay and Forked River on Barnegat Bay—emphasized the provision of home ports on an annual-lease basis for permanent "residents," minimum space being required for transient or short-term visitors. At Atlantic City, however, it was thought probable that transient trade would predominate. Mecca of the vacationer and conventioneer, Atlantic City, it was felt, would shape the habits of the marina clientele.

Further, the Atlantic City area is noted for regattas and tournaments organized by boat clubs and yachting organizations. There was every indication that America afloat was exploring the coastal waterways and would need a temporary port while stopping in the city.

With the cooperation of boat organizations and builders, a survey of boat dimensions was made to determine appropriate berth sizes. It was found that two standard berths sizes could be used. These are classified as the 30-ft berth, accommodating boats under 30 ft in length with a beam of 11 ft 6 in.; and the 40-ft berth for boats up to 40 ft in length with a maximum beam of 12 ft 6 in.

A limited number of larger berths, classified as 50-ft and 65-ft berths, will be provided for larger boats. Craft longer than 65 ft will be moored at the end of the T-shaped piers.

The 1,300-ft side of the basin along Huron Avenue, the access street, was found to accommodate 6 piers and two single-sided bulkhead piers at the ends. Two additional piers were arranged normal to the west end of the basin, making a total of 10 piers. See Fig. 1. This layout provided 355 berths, not counting the T-shaped ends of six of the piers.

Pier No. 7, constructed last summer and similar in most aspects to the piers previously constructed, extends 420 ft into the basin. At the end of this 10-ft-wide pier is a T-shaped head 82 ft long, which provides a mooring berth for a larger boat (up to 130 ft). Extending from the pier on each side are catwalks to give easy access to the moored boats.

Three-pile bents, spaced on 12-ft centers, support both the pier stems and the T-heads. See Fig. 2. Most of the supporting piles for the piers are driven to 43 ft below mean low water for bearing. The elevation of the pier deck was fixed at 8 ft above mean low water, taking into account the normal tide range of 4 ft, the storm-tide height of 7 ft, and the maximum tide of record of 9.5 ft. The general elevation of the upland is 10 ft above mean low water.

The bents are provided with 4 x 12-in. pile caps dapped into both sides of the tenoned pile heads. These pile caps support four inner lines of 3 x 12-in. stringers and two outside lines of 4 x 12-in. stringers. Bridging be-

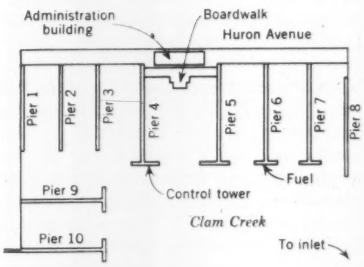


FIG. 1. A total of ten piers is planned for the state-city marina at Atlantic City. Piers 3, 4, 5, 6, 7 and 8 have been completed to date, bringing the number of available berths to about 220.

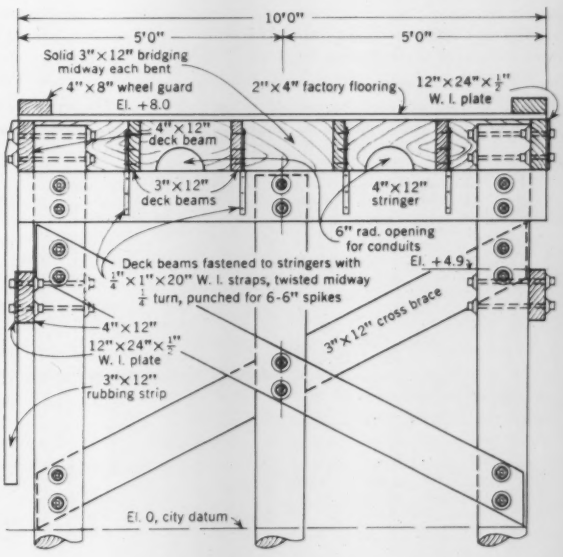
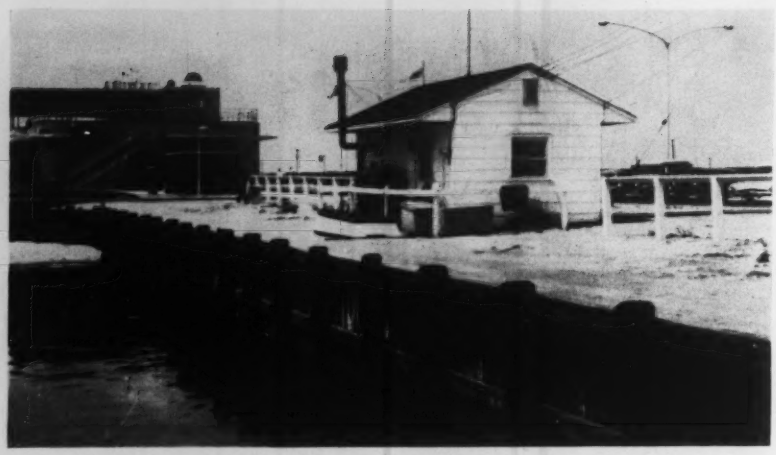


FIG. 2. Three-pile bents, spaced on 12-ft centers, support both pier stems and T-heads. Substructure is strengthened by bridging between the stringers and cross-bracing on the pile bents.



A bulkhead of pressure creosoted sheetpiles was constructed to retain the fill at the land end of the piers. A row of 4-in. vertical tongue-and-groove sheeting 20 ft long is supported by 28-ft line piles spaced 8 ft on centers. The bulkhead is anchored by 26-ft wrought-iron tie-rods to a line of 25-ft anchor piles set back 24 ft from the bulkhead.

tween the stringers and the cross bracing on the pile bents strengthens the substructure. Pier decking consists of 2 x 4-in. factory flooring laid with a $\frac{3}{8}$-in. space between planks.

Catwalks extending from each side of the pier have a minimum length of 12 ft. Longer catwalks are required for berths accommodating the larger boats. The catwalks, 2 ft 6 in. wide, are pile supported at 6 ft above mean low water and are reached by three steps leading down from the pier stem. See Fig. 3. Each walk serves two berths. Catwalk decking, consisting of 2 x 4's, is carried on two 3 x 12-in. stringers bolted to the inside of the outer bearing piles and to vertical 6 x 6-in. timbers at the pier. Catwalks 16 ft and 20 ft long have an extra bearing pile for support at the mid point.

Mooring piles are installed at the outboard end of each berth and also at the mid point, except on the catwalk side. All pier piles are pressure treated with creosote oil for longer life in sea water. All timber members other than decking and fender plank are similarly processed. Mooring piles are pressure creosoted with a reduced amount of oil to produce a dry surface. The decking and fender planks are salt-treated.

Fender planks are hung along the sides of the piers to prevent boats from "hanging up" under the piers and contacting the creosoted members. Rubbing strips are placed on the mooring piles.

Riding irons or travelers are used for mooring. These galvanized steel bars are mounted vertically on the mooring piles and pier face. The mooring lines of boats are fastened to brass rings, which slide up and down the bars as the tide raises and lowers the vessels. This arrangement permits security with the least possible handling of lines. On the pier face the riding irons are 3 ft long, and on the mooring piles, 4 ft long. Cleats are provided only on the T-shaped pier heads for the mooring of larger vessels.

At the land end of each pier a bulkhead of creosoted sheetpiles was constructed to retain the fill. A row of 4-in. vertical tongue-and-groove sheeting 20 ft long is supported by 12 x 28-ft line piles spaced 8 ft on centers. The bulkhead is anchored, by 26-ft wrought-iron tie-rods, to a line of 12 x 25-ft anchor piles set back 24 ft from the bulkhead line. The space between the anchor piles and the bulkhead was later filled in.

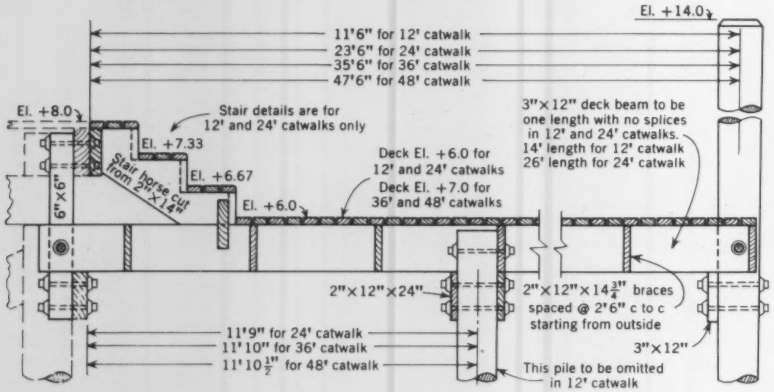
Simultaneously with pier construction, other marina improvements have been made to accommodate the boating public. A one-story masonry administration and concession building, 48 ft x 192 ft, with a covered roof deck, has been erected on Huron Avenue between Piers 4 and 5. In addition to the marina office, this building contains a restaurant, cocktail lounge, snack bar, marine store, toilets and showers. A feature of the building is the full-length sun-deck and promenade affording a good view of the seaport and inlet area. In front of the building there is a boardwalk, 32 ft x 300 ft, and a four-level boat-landing stage.

Huron Avenue, the access street, has been modified into a 100-ft dual parkway with modern lighting and a circle connection to Brigantine Boulevard at the west end of the marina. A 250-car parking area has been completed on city property opposite the administration building on Huron Avenue.

Several additional services are provided for the convenience and safety of boat owners. Each pier is furnished with outlets for lighting, fresh water, electric power, and television, as well as storage lockers. Fire extinguishers and ladders are provided throughout the length of each pier and in addition the piers have been designed to carry local fire-fighting apparatus. There is a control tower and public address system at the outboard end of Pier 4. At the end of Pier 6 is a marine service station, and at the land end of this pier is an ice supplier.

The five-year building period that has elapsed since the first piers were started in 1954, has afforded an opportunity to consider possible modifications in keeping with new trends in boat design and size. No basic changes have been found necessary, but the popularity of the trailer-boat has hastened installation of a small-boat launchway and mooring area. Plans are being made for the construction of these accommodations at the northeast corner, adjoining Pier 8.

FIG. 3. Catwalks, each arranged to serve two berths, vary in length from 12 to 48 ft. They provide easy access to boats, a feature not found at many marinas.


El. +14.0
11'6" for 12' catwalk
23'6" for 24' catwalk
35'6" for 36' catwalk
47'6" for 48' catwalk
El. +8.0
Stair details are for 12' and 24' catwalks only
El. +7.33
El. +6.67
El. +6.0
Stair horse cut from 2"×14"
6"×6"
Deck El. +6.0 for 12' and 24' catwalks
Deck El. +7.0 for 36' and 48' catwalks
3"×12" deck beam to be one length with no splices in 12' and 24' catwalks. 14' length for 12' catwalk 26' length for 24' catwalk
2"×12"×24"
2"×12"×14¾" braces spaced @ 2'6" c to c starting from outside
3"×12"
11'9" for 24' catwalk
11'10" for 36' catwalk
11'10½" for 48' catwalk
This pile to be omitted in 12' catwalk

Separation of launching ramp from boat slips is a feature of this West Coast marina. Dike-protected basin has a well planned entrance, maneuver area, and separate exit. There is also an adequate parking area close by.

PLANNING AND DEVELOPMENT OF CALIFORNIA'S MARINAS

JAMES W. DUNHAM, M. ASCE

Division Engineer

Division of Small Craft Harbors

Department of Natural Resources

State of California, Sacramento

During the past decade America has taken to the water in boats by the millions. In the past five years alone, the number of water craft in use has increased 41 percent. Well over 7,000,000 small craft of various types are being used, principally for recreation and to a lesser extent for commercial purposes.

As with any new recreational pursuit, the facilities have lagged far behind the demand. The few boat basins that were in use at the start of the upswing in boating were soon filled to capacity. Private interests have met some of the need by providing additional moorage of various types. However, most of these private developments are inadequate; many were built with the idea of taking in the greatest amount of revenue with the least possible output. The builders found very little written material to guide them in their efforts, and each patterned his installation according to the peculiarities of the site and the requirements of the potential user as he interpreted them. As these builders began to compare notes, certain aspects of small-craft harbor design became somewhat standardized. Planning criteria and acceptable standards of design began to evolve from the successes and failures of many small harbor construction enterprises throughout the nation.

The word "marina" was coined in 1928 to denote the modern small-craft harbor with all its facilities. The list of facilities that are normally provided at a marina has continued to increase with the growth of boating until it now comprises boat slips; gear lockers; launching and handling equipment; launching ramps; adequate parking area; facilities for repairs, sales, and service; and snack bars or restaurants. The list may also include lodgings, dry storage, a swimming pool, dressing rooms and showers, a clubhouse, and a shopping center.

Waterway development program

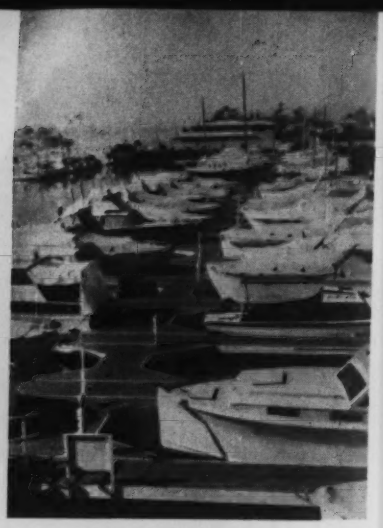
With the phenomenal increase in boating and the resulting pressure of numerous boating organizations, some states have now begun to participate in the development of their marinas and the interconnecting waterways. One of the first states to enact legislation for such a program was Michigan, where in 1947 a Waterways Commission was created with powers and duties to provide for the acquisition, construction, and maintenance of harbors and channels as well as many other incidental functions. The same act imposed a tax on boat fuel as a source of income for waterway development. The Commission also was given powers to negotiate and control boating within the boundaries of the state and to provide for state participation in federal construction programs. Other states prescribe only the regulation of boating as a state function but encourage the development of harbors and waterways by counties and municipalities.

In 1957 the California State Legislature passed the Small Craft Harbors Law, under which a Commission was set up with powers similar to those of the Michigan Commission, but with the further responsibility of handling a state loan project for the financing of small-craft harbors and improvement of interconnecting waterways by the various cities, counties, and special districts with harbor development capability. A separate division of the State Department of Natural Resources was set up by this bill and placed at the disposal of the Commission to carry out its directives and policies.

Pursuant to the Federal Boating Act of 1958 (the Bonner Bill), the legislature subsequently passed, and the Governor signed, Assembly Bill 828, giving the Department of Natural Resources authority to establish policy on boating regulations and registration to supplement the basic state law. The Small Craft Harbors Division has been authorized to carry out these functions for the Department.

California's loan program

The loan program is a new venture in the promotion of marina and waterway development. It provides for planning loans, repayable on a ten-year basis, and construction loans, repayable on a twenty-year basis. These loans draw interest for the state generally at the same rate as that of its other invested funds.



One of many floating slips in Newport Bay Harbor has strengthened connections between main catwalk and finger piers. Canvas covers on boats are used here in lieu of covered storage.

Repayment of the loans is normally on a progressive payment basis, the first payment being deferred to permit the recovery of some revenue from the development before the initiation of debt retirement. Sixteen planning loans, for a total of $122,500, have been granted, and several more are being processed.

The policy of the Division is to have these loan funds used to secure the services of the best available talent for harbor planning. Only the initial layout planning, rough estimates of cost, and evaluation of benefits are normally accomplished with these planning funds, in order to secure an accurate feasibility report. Engineering consulting firms are usually employed for this purpose by the local public agencies obtaining the loans. In some instances, however, the agency's engineering staff may have adequate talent and time to make the study without assistance other than technical consultation with the Small Craft Harbors Division staff and perhaps a private consultant.

All construction loans require legislative approval. Applications for such loans were received at the various Commission meetings throughout the year and a construction loan program was adopted for submission to the State Legislature at the December meeting. It was passed by the legislature on February 16, 1959. It involves 27 separate projects totaling approximately $15,000,000 worth of harbor and waterway construction. To date, the necessary planning and other requirements have been met. Construction loan warrants have been issued on three of these projects, and several others are currently being processed.

Three general sources of funds have been tapped for the prosecution of these small-craft harbor activities by the state. One source is the special investment fund, in which are deposited the surplus monies of the state, portions of which may be transferred to such activities as those of this Division by act of the legislature. Other funds are transferred to the Division from the unreclaimed portion of the boat fuel tax collected by the state. A third source is a bond issue that was authorized by the people of the state in the General Election of 1958. It should be noted that the taxpayers are not asked to subsidize this harbor and waterway development program except for a small amount of funds appropriated for the initial organization and operation of the Division and Commission. It is probable that future funds spent outright will come from boat fuel taxes.

Planning loan requirements

A planning loan application requires a rough layout of the improvements desired, an estimate of the initial project cost and annual charges, and an evaluation of anticipated benefits. Other requirements include certifications by the governing body of the local public agency that the property required for the project can be acquired at reasonable cost, that the agency intends to continue without delay to completion of at least a usable portion of the overall project once the loan is granted, and that the project when completed will be made available to all on reasonable and equal terms. All information pertaining to zoning in the project area, flood-control and water-pollution problems, land-ownership status, and pertinent information on existing facilities and prior studies must be submitted with the application.

Once the planning loan is approved by the Small Craft Harbors Commission, the feasibility study may begin. The preliminary plans are reviewed and expanded, engineering feasibility is checked, probable revenues are determined, and a careful study is made of the benefits expected to accrue from the project.

Early in the program it became evident that many of the public agencies did not know how to proceed to obtain the required engineering services. Some city councils were forcing their administrators to call for bids for such services in much the same manner as for a construction contract. The Division therefore prepared a Procedure Outline for Small Craft Harbor Surveys, which not only provides a check list of the items to be covered in the feasibility study, but indicates in detail the proper method of negotiating for the services of the consultant. The approved procedures of the American Society of Civil Engineers and other professional agencies and associations were written into this procedure outline. No further difficulty has been encountered with the initial planning effort.

Personnel of the Small Craft Harbors Division engineering staff assist the public agencies and their consultants in the course of the feasibility study through review of plans and evaluation of benefits. This assistance is given both during the initial-draft stages of the report and on final completion. Favorable action on a construction loan application is of course contingent on the prior completion of a feasibility study satisfactory to the Division. The feasibility study may be accomplished either with a state planning loan or with the agency's own funds. Similar assistance by the Division staff is offered in either case. Preparation of the construction plans and specifications is left for the initial phase of the construction effort.

The Division staff is too small to provide other than technical consultation for the agencies sponsoring the projects during the construction stage. The technical assistance offered is in the nature of advice on the preparation of invitations for bids, assistance with analysis of bids if requested, consultation as to supervision and inspection methods and procedures to be used, and periodic field checks as work progresses.

General planning

There is a wide diversity of opinion concerning the elements of marina development, both as to layout and structural makeup. As for layout, a few general concepts have been adopted. Launching ramps and outboard activities should be separated as much as possible from the berthing facilities of the

Covered floating slips offer protection in hot interior areas, where wooden parts of boats deteriorate rapidly in the open.

permanent fleet. The larger boats of the permanant fleet should be moored near the main entrance to the marina. This is especially true for sailing craft. Some of the slips near the entrance should be reserved for transient visitors. Guest slips acclaim the hospitality of the marina owners, promote good will, and encourage reciprocation of the hospitality offered.

Requirements for storm protection of a marina are determined by the characteristics of the body of water on which it is located. If the development is on the seacoast, massive breakwater protection is required, and rather elaborate studies are needed not only to determine the design wave but to plot the attenuation of wave action that comes in through the entrance as well.

The planning requirements for harbors on seacoasts have been studied for many years by the U.S. Army Corps of Engineers as well as by other agencies of state and federal government. Much has been printed on the subject so that these requirements are better known to most harbor engineers than are solutions to the problems on inland waters.

Some of the lakes and reservoirs that are now being developed for recreational purposes are so small that the marina requires little or no protection against waves. In larger bodies of water some type of breakwater protection is required. Very frequently a large rise and fall in the water-surface level precludes the use of fixed structures for this purpose. Some protection is afforded by the use of log booms, which are relatively inexpensive and can be easily adapted to changing water levels. Experimentation along these lines is needed to devise some economical form of floating or movable breakwater that will provide the necessary protection for small marinas.

A possible partial solution to the problem of fluctuating levels of inland waters is the use of dry storage. Modern handling equipment has become so efficient that lifting boats out of the water and storing them in racks can be done economically and quickly.

Design of facilities

The modern boat owner has come to regard many facilities that were formerly obtainable only in the most expensive yacht harbors as essential needs. These include water and electric systems throughout the floating-dock area, telephone connections, fire protection equipment, gear boxes, and night lighting. Most slip renters like to do much of their regular maintenance work while the boat is in the slip. The provision of means for accomplishing this is a part of the marina planning effort. One of the problems to be solved is the stability of the floating system. Care must be exercised in placing utility lines and superficial loads so that the deck will not be canted, and considerable rigidity must be built into the connections between the main deck and the catwalks between slips.

Along the ocean shore and for a distance of perhaps a score of miles inland, the daily sea breeze and frequent fogs keep temperatures low enough and humidity high enough to obviate the necessity for covered storage. In the hot interior areas, however, the wooden parts of water craft left in the open deteriorate rapidly and covered storage becomes a necessity.

Where the rise and fall of surface level is limited, sheds can be placed on piles, with floating slips riding the surface beneath them. However, where the rise and fall is considerable, the sheds must be floating as well as the slips. The most commonly used siding for such sheds is corrugated sheet metal. Conventional galvanized sheets are rapidly giving way to sheet aluminum because of the latter's lightness, durability in both moist and hot environments, and greater reflective quality. In areas exposed to high winds, the sheds must be sheathed to the water line.

Launching ramps

Several special engineering problems have arisen in connection with the planning of launching ramps. Where the rise and fall of the water surface is limited, a short ramp is adequate, but where the rise and fall is great, a considerable length of ramp must be provided that will be submerged much of the time. Asphaltic concrete has been rejected in most instances because of its tendency to become slippery as a result of oil spills and accumulations of silt and clay. Concrete is preferable when left with a coarse-broomed surface, with horizontal grain. Dry precasting of submerged slabs, or unwatering of submerged ends and dry placement, is preferred to tremie placement.

Some experimentation has been carried out with portable and semiportable ramps of various types. These consist of interlocking reinforced concrete slabs placed on gravel beds, articulated concrete mattresses, pierced metal planks, and open-mesh grids of various designs.

One of the principal problems in connection with launching ramps is that of traffic control. Adequate maneuvering room must be provided for the less-experienced trailer operator, and ample nearby parking space must be made available for the full quota of boats and trailers that may be expected on the busiest day of the season.

One of the most prevalent sources of delay in the launching process is in the removal of the launched boat from the ramp area to a docking area. The idea of a docking area adjoining a launching ramp is fairly new, and various types have been attempted, ranging from a raised walkway along the side of the ramp to a nearby floating dock of some type. Considerable study is indicated along these lines. One system that has been suggested is a type of tackle that would permit a single operator to attach his boat to a docking line before launching, to launch the boat empty, and from his launching position to haul the boat over to the dock unattended.

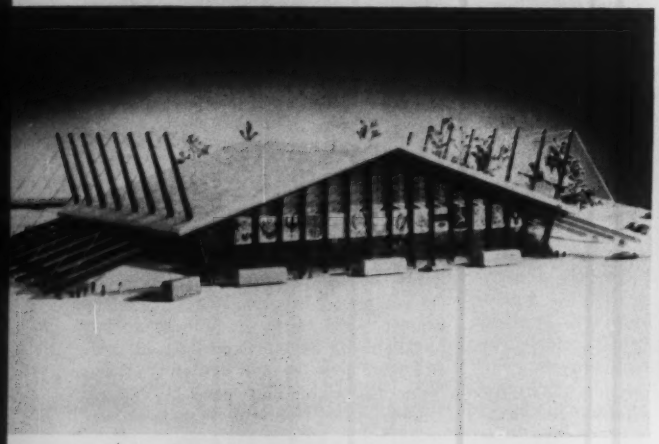
FIG. 1. When planning a marina, designers strive for maximum convenience and comfort for boat owners, as in this example at Redondo Beach, Calif. Numbered areas indicate the following: (1) completed breakwater, (2) berthing area for 1,900 boats, (3) launching area for 450 trailer boats, (4) parking, (5) central office dist., (6) civic center, (7) shopping, (8) swimming cove, (9) park. Other facilities available include restaurants, hotels, supply and repair shops.

Because of the time and inconvenience involved in launching a boat by ramp, modern, faster methods—such as monorails, cranes, or derricks—are becoming more popular. Equipment of this nature has often paid dividends in emergency situations caused by high winds, high tides and fires by making it possible to get boats to safety before they were severely damaged. Novices using a single ramp may get only three boats in the water in an hour, whereas with a monorail, crane, derrick or other such device as many as fifteen boats an hour can be launched.

The engineering challenge

The opportunities for improving the design standards for marinas are legion, and the civil engineer is currently being challenged to exercise his ingenuity in such endeavors. The California Division of Small Craft Harbors hopes to stimulate this effort and to become more proficient in fulfilling its harbor and waterway development functions as it acquires more experience. The Chief of the Division is H. G. Stevens, and the Division Engineer is James W. Dunham, M. ASCE.

Model of Ice Arena (below) for 1960 Olympic Winter Games is seen from the north or closed end. Main steel roof framing is in place for Olympic Arena (at right). Backstay anchorages are connected but final covering has not been placed. Near end will be entirely open in the finished structure. Speed skating rink is in foreground.



Cable-supported roof for Olympic Arena

SAMUEL H. CLARK, M. ASCE, District Engineer

American Institute of Steel Construction, Inc., San Francisco, Calif.

The Olympic Arena for the VIII Olympic Winter Games in Squaw Valley, Calif., is a building as wide as a football field is long, and capable of accommodating 8,000 spectators. The Arena, with one end completely open, will support some of the heaviest snow loads in the Sierra Nevada.

This building will be the shelter for figure skating and ice hockey and the official opening and closing ceremonies for the Olympic Winter Games, to be held February 18 to 28, 1960. Its cable-supported roof makes the steel frame appear to act almost like a bridge, and the 87-ft height of the glass-enclosed north wall, combined with the open end on the south side, involved many interesting design problems requiring unique solutions.

In the original concept of a building like this, with plan dimensions of 224 ft by 300 ft, it would perhaps seem logical to orient the ridge of the roof in the long direction. In this building, however, it was necessary to have one open end to provide the spectators with a view toward the Speed Skating Rink, the Olympic Flame and the Ski Jump, and it was desirable to have this opening on the longest side. With the inside ice rink oriented so that its long dimension is perpendicular to the ridge, the better seats become parallel to the long side of the rink and also afford a view straight out the open end. See Fig. 1.

The Olympic Arena is the hub building of what will be virtually a small city. It dominates the entire valley, which has been transformed from a wilderness area to a superlatively equipped facility for the Olympic competition. Squaw Valley is a naturally beautiful pocket in the Sierra Nevada at an elevation of about 6,200 ft, only a few miles from Lake Tahoe and the California-Nevada line.

Athletes from some 33 countries will be housed in the "Olympic Village." Facilities for athletes' housing, dining and recreation, and for the press, as well as three ski lifts, ski jumps, lounges, spectator centers, speed skating and practice rinks, parking for 12,000 automobiles, and even complete water supply and sewage disposal systems, are included in the tremendous construction undertaking. The California Division of Highways proceeded meanwhile with the widening of U.S. Highway 40 and State Highway 89, the road linking U.S. 40 to Squaw Valley. The Organizing Committee anticipates that as many as 35,000 spectators will witness the competitions, which will extend over a period of 11 days. Incidentally, parking facilities are to be provided on compacted snow, another example of a unique solution to an engineering problem.

After the Games are over, the California Olympic Commission expects to turn over all the facilities to the State Park Commission. The Arena, the rinks, Olympic Village, and the ski lifts and runs will then be operated as a part of the State Park system.

Design of the Arena

A total of 8,000 seats are set on three sides of the 85 x 190-ft ice-hockey rink, including two movable sections of bleacher seats. The movable bleachers can be made to face in towards the ice rink or perpendicular to and in line with the fixed bleacher seats at the ends of the rink, for the opening and closing Olympic ceremonies.

To meet the requirements of this $3-

million structure, a number of structural schemes were considered in the preliminary stages. After various possibilities were rejected, the mast-and-cable-supported roof system was chosen.

Roof design

The original basis for the roof design was a snow load of 100 psf. This was later reduced to 50 psf by designing a refrigeration and heating system to melt the snow by pumping hot air through the cells of the roof decking. The design snow load is based on a 50-year storm, and the safety factor will allow for a temporary load of up to 80 psf without structural damage. The roof structure consists of a cellular steel deck spanning about 12 ft, supported by 16 WF 36 purlins and by the main supporting frames on 32-ft centers. See Fig. 2. The main members, with a 4-to-12 pitch, are tapered steel box girders, supported by inclined cables; these in turn are supported at the top of inclined tapered columns.

In this design, metal decking, by its diaphragm action, provides a roof bracing system to resist the lateral forces of wind and earthquake. The decking also provides lateral support for the compression flange of the purlins. The purlin design is based on simple spans, and the deck is utilized to provide the action of sag rods. Even though the omission of sag rods caused some problems in erection, it resulted in a desirable uncluttered appearance. The lower surface of the decking is a flat plate for best appearance and also to provide the most effective diaphragm action. The entire deck is a custom designed section with cells 4⅝ in. deep. An unusual function for the decking is to provide the finished roof surface. Special lapping details and Thiokol base joint sealant make this possible. A thin coat of plastic was placed over the entire deck.

The main roof girders, which also act as struts, are tapered steel box sections varying in depth from 2 ft to 3 ft 6 in. These sections have sufficient torsional rigidity to take bending stresses in the absence of lateral bracing. The web thickness of the box sections is less than the column formula would allow. The stability of the webs was checked by criteria developed for aircraft design.

Under maximum load, the ridge can deflect a total of 22 in., at which point the main girder ends meet. The amount of this gap was made such that the uplift value of the cable anchorage would not be exceeded. The magnitude of this movement at the ridge dictated the use of a pin at the girder-to-column base connection.

Since the two halves of the roof are completely separate structurally, and since the elastic stretch of the cables under snow load is in the order of several inches, an ingenious connection was devised for the ridge of the roof. This provides a weatherproof enclosure while still allowing considerable movement. This joint was designed for a condition of unbalanced live load and also to limit uplift due to wind. See Figs. 3 and 4.

Each half of the main supporting roof frame acts independently, somewhat on the order of a guy derrick, considering the roof girder to function as the boom, the column as the mast, and the inclined cables as guys. The cable design called for galvanized prestretched bridge strand of 2¼-in. diameter, with no adjustment equipment or turnbuckles, in order to provide a clean-cut appearance. Prestretched bridge strand has predictable elastic properties, which make this design feasible. J. A. Roebling's Sons Corporation prepared the strand for the structural steel fabricator, Pittsburgh Des Moines Steel Company. The bridge strands are not bent over the columns in a saddle arrangement, but each is cut to fit separately. Anchorages are provided at the back stay by a connection to the girder, which extends back and resists horizontal thrust. Uplift on the anchorages is resisted by the pile foundation.

Columns were tapered, partly for architectural appearance and partly to provide an efficient section to resist bending. Designed with a fixed base, and with the top pinned, each column is guyed in one direction and free in the other. Since bracing between masts was undesirable architecturally, stiffness in this direction was provided by the four-flanged cross-shaped section, made up from welded plate.

Cable elongation due to snow load produces high secondary bending stresses in the fixed-base columns. To avoid a combination of this stress with maximum axial compression, which would produce a critical condition for buckling, a special erection procedure was developed. The columns were prestressed, or deflected toward the backstay cable a predetermined amount so that they will be substantially straight at maximum axial load. The critical buckling strength of these tapered mem-

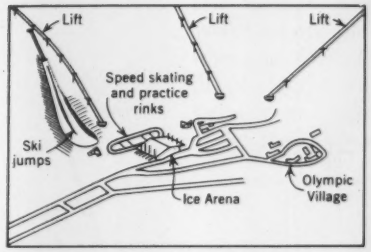


FIG. 1. Ice Arena for Olympic Games in Squaw Valley, California, a building as wide as a football field is long, houses rink for figure skating and ice hockey. Open end enables spectators to look out across speed skating and practice rinks toward the ski jumps.

WHO DID IT

Client: Organizing Committee, VIII Olympic Winter Games

Architects: Corlett and Spackman and Kitchen and Hunt, AIA, Architects Associated

Structural Engineers: H. J. Brunnier and John M. Sardis

Civil Engineers: Punnett, Parez and Hutchison

Sanitary Engineers: Kennedy Engineers

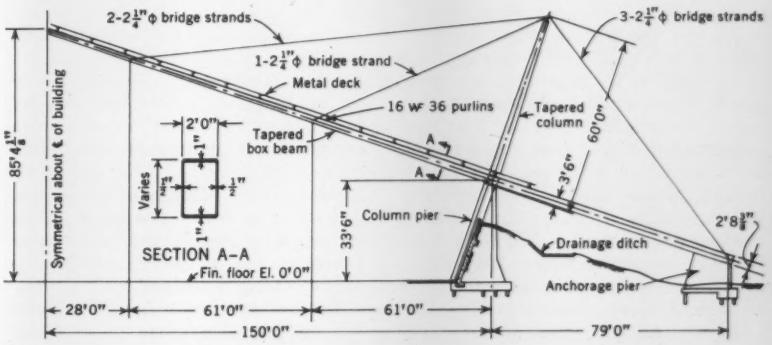
Mechanical and Electrical Engineers: Vandament and Darmsted

Soil Consultants: Dames and Moore

Transportation and Traffic Engineer: Arthur C. Jenkins

General Contractor: Diverisfied Builders, Inc.

FIG. 2. Half transverse section of main frame of Arena building shows 16 WF purlins which, together with the tapered steel box girders, support the cellular steel roof deck. The girders are supported by inclined cables which in turn are supported by inclined tapered columns.



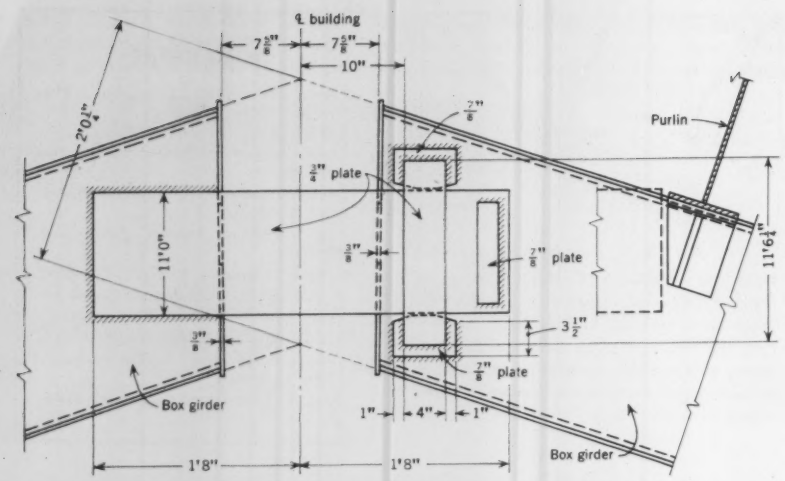


FIG. 3. Each half of the main supporting roof frame acts independently. Under maximum load the ridge can deflect a total of 22 in., at which point the ends of the main girders meet.

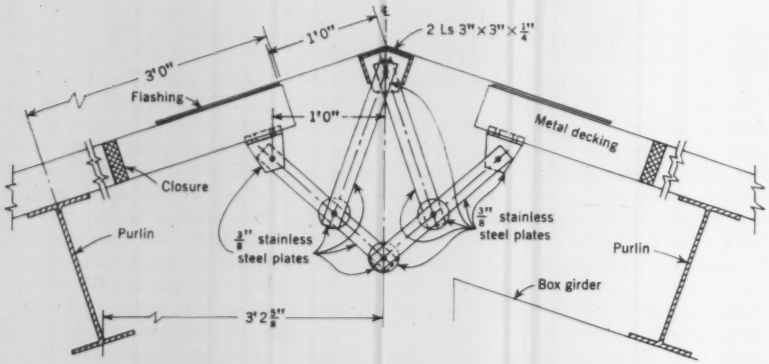


FIG. 4. An arrangement of steel plates provides a weatherproof enclosure at the ridge while still allowing considerable movement.

bers was determined from basic theory. The column-base design involved the use of shear lugs to take the horizontal component of the column reaction.

Another interesting detail is the connection between the steel framing for the roof and the end wall, on the north side of the building. There is considerable movement of the roof framing, due to changes in temperature and snow loads, and the wall is almost entirely enclosed with glass—with the exception of a spandrel of reinforced concrete panels which conceal and support the top of the grandstand inside. This tremendous expanse of glass was designed for a wind load of 20 psf. The deflection of the steel mullions was the controlling design criterion. Mullion connections are designed to require a minimum of connection material. All welds are groove welds and are required to be ground on the surface.

A total of 1,098 tons of structural steel was used in the Arena. Roof framing for the 300-ft span amounted to a load of 22 psf.

Heating and refrigeration system

Heating of the roof system for the melting of snow is accomplished by a reverse-cycle heat pump system from the refrigeration unit. A continuous duct extends along near the eave line, and each cell in the steel roof deck gets a share of the heat. In the unlikely event of failure of this heating system for an extended period, the roof has been designed to support snow removal equipment. Requirements other than snow melting also had to be met by the heating system. Because of erratic temperatures, and the possibility of extremely cold weather and condensation problems, partial heating of the area over the seats is planned.

The refrigeration system is designed for the largest expanse of artificially frozen ice ever used. This means a refrigeration plant capacity of approximately 600 tons, which produces 9,000,000 BTU of heat. Ducts between the roof purlins and above the bleachers are used to carry the main heating air. The interior of the box girders is also heated with warm air to reduce condensation on these members.

Foundation design

Step-tapered concrete piles were used for the foundation, a surprising design in this mountainous location. The piles were required to avoid differential settlement because of the presence of pockets of silt in the deep alluvial deposits of the valley floor. The support of the ice rink itself was a problem because of the close tolerances required for competition. In this case, however, a preconsolidation method was chosen instead of piles, and 6 ft of surcharge fill was placed for a period of six months to consolidate the area. A concrete slab 5 in. thick is used for the ice rink itself. The thickness of the ice over the slab is 1 in., and the smoothness of the ice surface is controlled to a tolerance of plus or minus ⅛ in.

Along the short sides of the Arena, retaining walls slope out parallel to the columns. These walls span 32 ft horizontally between the column piers and hold the earth berm, which will be backfilled against the building. This berm has an ingenious drainage trench located to catch the melting snow that will slide off the roof. Heating pipes are provided in this trench to insure that the snow is melted and carried off.

Grandstand design

The permanent grandstand seating in the Arena is laid out so as to provide an unobstructed view from any seat over the top of a person seated in the second row in front. This calls for a parabolic shaped section through the grandstand. Reinforced concrete seat units were chosen for this "structure within a structure," which includes space under the seating for dressing rooms, snack bars, and press, radio, and television facilities. The mezzanine floor, incidentally, has a "Sonovoid" concrete slab, which reduces dead weight. In addition to rooms for the necessary facilities, space is provided for refrigeration equipment as well as for a 40,000-gal reinforced-concrete brine tank.

Few structural design projects have presented so great a variety of challenging problems, and perhaps few projects have offered so many original solutions. All indications are that the Arena will give a performance exceeded only by the Olympic competitors who will use it.

ALASKA has a huge potential for engineered construction to meet the needs of the area for transportation, water supply and sanitation, and development of natural resources. Several articles in this issue tell of engineering problems and solutions in "The Great Land." These articles were prepared by members of the Alaska Section under the guidance of Harold R. Peyton, M. ASCE.

Civil engineering in Alaska

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To many, the new state of Alaska is a land of ice and snow where there is little if any need for engineers or engineering. The essential part that civil engineers have played and are playing in the development of "the great land" (Alaska means "great land") is an intriguing story. They have contributed much, but the future of the state will demand an even greater contribution.

Status of civil engineers. Civil engineers have been prominent in the development of Alaska's mining industry, fisheries, power developments, highways, railroads, communications, forest industry, waterways, airfields, oil industry, educational system, military defense, communities, rivers and harbors, and many other natural and human resources. Three of the 16 American governors of Alaska attained eminence in civil engineering work before they became the political heads of the area. Civil engineers participated in writing the constitution for the new state and many have served in the legislature. They have served as administrative heads for the largest communities in the state and have planned and developed municipal public works programs within the principal cities.

One out of each 34 individuals listed in the current edition of the Alaska Who's Who, *Alaska—Who's Here,* is a civil engineer. Civil engineers constitute almost 50 percent of the registered professional engineers listed in the current Alaska registration list. There were 482 registered professional engineers and engineers-in-training as of December 31, 1958.

Research and development. Global defense plans and population movement to previously undeveloped areas have caused communities of only a few hunters, trappers, and miners to become boom towns in some parts of Alaska in the past ten years. The Alaskan engineer, faced with an urgent need for his services, must occasionally pause to broaden his perspective and reorient his thinking. He must be cognizant of rapidly changing political and social conditions. The planning and building of advance facilities and permanent communities in arctic and subarctic regions call for redoubled interest in technical advancement. Professional and technical publications play a particularly important part in the development of Alaska since local reference literature is inadequate and often inaccessible.

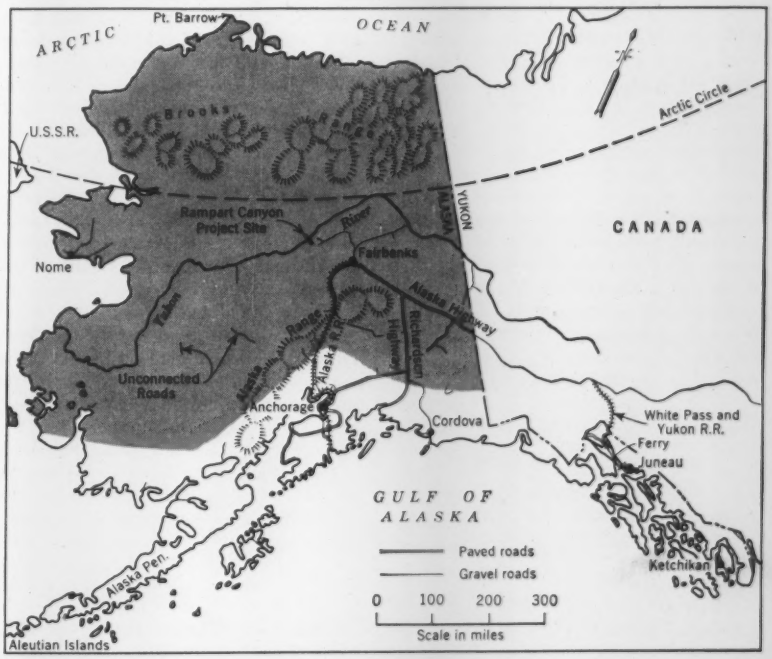
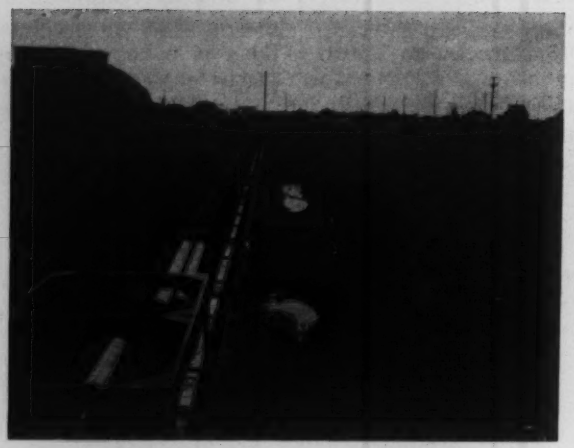


FIG. 1. On map of Alaska, permafrost area is indicated by shading.



Reinforced concrete utilidor is seen under construction near Fairbanks, Alaska. Note metal car on wheels, which is used to lift materials into place.

House water-service device used at Fairbanks, Alaska, provides circulation between the street main and the property served. Velocity in the street main causes circulation of water in the house service pipes.

Further field and laboratory study is needed in practically every phase of cold-weather civil engineering. Under arctic and subarctic conditions, the physical states of soils, fluids, and various materials of construction change appreciably. Chemical and biological reactions are generally retarded. Thermal characteristics, heat conservation, humidity and light, construction and operation costs, logistics, and the efficient use of resources and materials assume even greater importance. Thorough and adequate cold-weather civil engineering work pays greater project dividends than conventional practice. The research effort in determining frost effects, the usefulness of snow, ice and permafrost as structural materials, the characteristics of low-temperature biological systems, and the effectiveness of engineering methods, materials and processes have assumed great importance. Cold-weather research offers an unending challenge for the future.

Surveying and mapping. The tedious task of surveying and mapping the coasts and interior of Alaska, which started with the work of Vitus Bering in 1729, continues today as an important function. Throughout the eighteenth and nineteenth centuries more than a score of Russian, Spanish, British, and French navigator-surveyors contributed to this task. Millions of acres must now be surveyed to fulfill the requirements of the Alaska Statehood Act.

Highways. In 1957 the highway system totaled about 4,000 miles. Efforts are now being made to provide an annual 20 to 40 million-dollar road-building program. Also, as a part of the highway program, plans are being studied for the development of a ferry system through Alaska's inland and coastal waterways. There is serious need for extension of both primary and secondary road systems as well as for the improvement of the present routes.

Communications. The DEW Line, extending not only across the arctic coasts of Alaska but also across northern Canada, is a modern miracle of communication. Civil engineers played a great part in planning and constructing both this and the White Alice project. The White Alice communications system is made up of 21 scoop-shaped, 60-ft structures and service facilities which weave a telephone and telegraph network. These structures, many in remote places initially only accessible by helicopter, enable combat centers to receive reports of aircraft detected by the distant early warning line (DEW Line) of radar outposts. They also facilitate civilian communication.

The two projects make up a communication network connecting strategic points with all parts of Alaska. Even the most remote sector of the central land mass is accessible in this most modern of communication networks. Problems of constructing facilities on mountain tops, in frozen or rocky soils, and on the unstable muskeg bog lands of the plains, which appeared almost insurmountable, were solved. These multimillion-dollar facilities serve both military and civilian needs.

Defense facilities. Beginning with the simple Russian fortifications built at Sitka at the end of the eighteenth century, far-flung military civil engineering works have been built across the length and breadth of Alaska. Airfields, harbors, roads, military bases, missile sites, and numerous supporting facilities have been designed and built. Although many have been decommissioned or relocated, several remain as an essential line of defense for the North American continent. Among the military civil engineering works in Alaska are the 50-million-dollar Navy oil exploration program, pipelines several hundred miles in length, the 114-million-dollar International Highway (the Alaska Highway, which is partially in Alaska), multimillion-dollar submarine cables, more than a dozen airfields as large as those servicing the largest cities of the continental United States, several large military bases, and many similar facilities. Defense-related construction programs have represented an outlay of almost a half billion dollars a year.

Sanitary engineering. Many ingenious methods and facilities have been developed to provide modern water supply and waste disposal facilities for Alaskan communities. Sewers and other utility lines have been placed in heated conduits called "utilidors." Single-main and dual-main water systems have also been provided, designed so that the water can be heated and circulated. Water treatment facilities designed to treat water at low temperatures have been provided for permanent installations. The operation of land-fill garbage disposal sites in permafrost has been possible through appropriate design for site selection and management. Fairbanks and Anchorage, the largest cities in

Alaska, which are also military bases, are served by multimillion-dollar projects to provide modern utilities.

Hydrology and hydraulics. Although numerous individual investigations of water availability and quantity were made earlier in connection with mining projects, the first organized collection of hydrological data was instituted by the U.S. Geological Survey at the beginning of the twentieth century. Data were collected on the Seward Peninsula at that time. Investigations began on the water supply of the Yukon-Tanana region in 1907. The several reports and studies carried on since that time make up only a small part of the work necessary for proper resource development. Permafrost affects hydrological characteristics, and detailed studies are essential.

The Fairbanks Exploration Company (USSRM) has relied on engineering genius for the planning and design required to thaw frozen ground and remove gold through extensive placer mining operations. A 76-mile pipeline with numerous siphons and valley and mountain crossings diverts the flow of the Chatanika River and several smaller streams to a point where the water can be used for thawing the frozen soils and for dredging operations. These multimillion-dollar projects and the power facilities necessary for dredging and community use were planned and constructed by civil engineers with the help of the necessary supporting services.

Waterways and harbors. It would be impossible to estimate the man-years of civil engineering effort that have gone into the development and maintenance of Alaskan waterways and harbors. Hundreds of aids to navigation have been placed along the 26,000-mile coastline. Charting of the myriad channels, coves, inlets, and harbors is yet unfinished.

Airports. Alaska has 40 major airports and more than 20 supplementary ones. There are scores of relatively unimproved landing strips. Lack of roads and great distances are responsible for the air-mindedness of Alaska. Scheduled passenger arrivals and departures from Alaska's three largest civilian air terminals put these airports among the top ten of the United States. There is urgent need for improvement of existing airfields and construction of new facilities.

Power. There is an estimated minimum of 8.3 million kw of potential hydroelectric power that can be feasibly developed in the state. This would generate approximately 46.9 billion kwhr of firm energy. Many power sites have been developed in connection with mining operations but these developments are only the beginning. Proposals are being considered for the construction of nuclear power facilities in areas where energy is at a premium and logistics favor nuclear power. Multimillion-dollar power generation facilities utilizing Alaska coal have been constructed to serve military and civilian communities in the central part of the state.

Past accomplishments and plans for the future. Civil engineers, young and old, experienced and inexperienced, may well feel the challenge of Alaska. Many significant civil engineering works have been built and are to be built in the state. Physical characteristics and economic need have dictated the specific nature of many of the engineering works. The following ten are outstanding civil engineering achievements serving the citizens of the new state:

1. The Alaska Railroad, built at a cost of $120,000,000 over mountain passes and through some of the most difficult permafrost terrain, before our present knowledge of design and construction in such areas had been developed.
2. The early coastal surveys of Capt. George Vancouver.
3. The Richardson Highway leading from the port of Valdez to Fairbanks.
4. The communication network created by the DEW Line and the White Alice projects.
5. The recircling-water distribution system serving the city of Fairbanks.
6. The Eklutna hydrolectric plant serving the Anchorage area with an annual firm output of about 100 kwhr.
7. The petroleum pipeline from Haines to Fairbanks.
8. The airfield at Eielson Air Force Base near Fairbanks, capable of handling the largest aircraft, although constructed in a permafrost area.
9. The refrigerated-footing technique applied to early tower construction in Navy Petroleum Reserve No. 4 at Point Barrow.
10. The Ketchikan Pulp and Timber Company mill and supporting facilities at Ketchikan.

With the achievement of statehood, a rapid population growth has been predicted. Predictions for the increase in population range from a million to three million in the next decade. A second 50-million-dollar pulp mill is under construction, and all major oil companies are now engaged in exploration. Anchorage, the largest city in Alaska, is beginning to plan for an increase from its present estimated 60,000 people to a population of a half to three quarters of a million by 1975. One nuclear power plant is to be built and a second is in the planning stage. Numerous industrial, merchandising, and professional groups are making market studies and surveys of Alaskan opportunities.

Thermometer is in place in temperature determination well in water distribution main. This method is used to determine heat loss in recirculating water distribution system at Fairbanks, Alaska.

The new Alaska constitution calls for the utilization, development, and maintenance of replenishable natural resources on a sustained-yield basis. This objective demands planning by engineers and the efficient use of resources and materials. The constitution also states that the legislature may provide for facilities, improvements, and services to assure greater utilization and development of certain natural resources.

Heat exchanger heats antifreeze, which is then recirculated through the well in foreground. This method, used at Bethel, Alaska, prevents freezing of the well, which is located in permafrost.

ENGINEERING RESEARCH IN ARCTIC ALASKA

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There are few engineering problems in the Arctic that cannot be adequately solved using the present body of technical knowledge, aided by improvements that can be expected to result from normal research and development. It is essential, however, to appreciate the importance of the relatively few problems that are peculiar to arctic and near-arctic climates. In general, these problems are related to the presence of ice where water would be found in temperate climates. The low temperatures themselves do not cause handicaps of an engineering nature except in relation to equipment and environmental health, neither of which will be discussed here.

The presence of ice becomes important on all projects that involve the land or water as a platform on which to rest or operate. Ice is found on all bodies of water for a substantial part of the year and is prevalent in soils perennially. Probably the most widespread interest is in permafrost, usually defined as soil that remains at 32 deg F or colder throughout the year. This definition takes no account of the moisture content of the materials or the physical state of the water; permafrost may range in moisture content from zero to 100 percent, and the included water solutions may be in the liquid or solid state.

Most of the difficulties encountered with permafrost involve settlement caused by the melting of ice where the moisture content exceeds the natural voids in the soil when thawed and consolidated. This condition is not unusual, and most failures can be attributed to it. An accompanying photograph shows a concrete slab-on-grade floor in a heated building which has settled as a result of the melting of permafrost with a high water content. Another photograph illustrates a road failure due to the same cause. It is obvious that this primary difficulty can be solved either by removing the objectionable material or by preventing the ice from melting.

Removal of permafrost is feasible only in a few areas where it is sporadic and thin, and proves economical only where the ice cannot be easily preserved. In many arctic areas, permafrost is found to depths of 1,000 ft or more, a condition that dictates the preservation of the ice in the subgrade. To prevent melting of the ice, the design must take into account thermal characteristics as well as strength; failure to understand or use a thermal design has been an important cause of failures.

One Alaskan research project that has made a significant contribution to thermal design is that carried out by two geophysicists of the U.S. Geological Survey, Max C. Brewer, at present Director of the Arctic Research Laboratory, Barrow, Alaska, and Dr. Arthur H. Lachenbruch, U.S.G.S., Menlo Park, Calif. Their primary field work has been the measurement of ground temperatures, using Western Electric thermistors as the sensing devices. By utilizing some 4000 thermistors, continuous data have been collected for 11 years from many different sources—highways, deep oil wells, lakes, the ocean, and a selection of open terrain

A road thermally designed, four years old, has required no significant maintenance to date. The vehicle shown, which belongs to the Arctic Research Laboratory, can negotiate loose beach sands and some snow, but is not adequate for tundra travel.

features. From an engineering standpoint, the results have been impressive. An example is the difference between the two roads shown in accompanying photographs. The one, designed on a thermal basis, using the information of Brewer and Lachenbruch, has remained stable for four years.

Several federal research organizations are active in ice research: the U.S. Army Engineers' Snow, Ice and Permafrost Research Establishment (SIPRE); the U.S. Army Engineers' Frost Effects Laboratory; Cambridge Research Center of the Air Force; the Naval Civil Engineering Laboratory; the Navy's Electronics Laboratory; and the Office of Naval Research. Only the Alaska work can be covered here.

The Navy's Civil Engineering Laboratory is studying reinforcement of sea ice by thickening of the ice sheet. Although there is a substantial amount of sea ice that is sufficiently thick to support extensive facilities, it is difficult to find an adequate floe at a desired location. More important may be the relative structural strength of adjacent floes. A very thick floe will better resist major damage, such as that which occurred at the floating scientific station Alpha, on an unthickened floe.

During 1959 this group studied ice growth rates as sea water was pumped onto the surface of sea ice. Although this technique appears simple, it results in a form of ice that does not exist in nature, except in overflows. When sea ice freezes from the surface downward, the resulting salt content of the ice is 4 to 7 parts per thousand as against 35 parts per thousand in the sea water itself. This is due to the natural exclusion of impurities during crystal formation. The remaining salt solutions in the ice slowly leach downward with the result that the surface ice provides a source of potable water, a fact that the Eskimos have used to advantage for centuries. When sea water is ponded on the ice sheet, the resulting thin section of new ice has a salinity profile that varies approximately from the salt content of new sea ice at the surface to a content in excess of that of sea water at the bottom. This bottom brine does not freeze solid, but only partially, as would be expected of such a salt solution.

Crude initial observations were made on the deflection and subsidence of flooded areas resulting from plastic flow of the ice at the relatively high ice temperatures caused by repeated surface flooding. All flooded areas sagged appreciably in the center. Entire test plots that had an increase in thickness in the order of 7 ft slowly punched through the original ice sheet so that only a foot or so projected above the original surface. Experimentation to secure more definitive data continues.

The Cambridge Research Center of the Air Force has studied a technique of flooding that would keep the salinity of the ice produced by flooding from significantly exceeding that of natural sea ice. This was done by allowing only a small part of the flooding water to become low-salinity ice and removing the remaining high-salinity water. Air Force Cambridge is also engaged in studying the strength of lake ice, using in-place cantilever beams and small specimens. These experiments are primarily to determine the structural strength of ice sheets for use by aircraft and other types of equipment.

Much of Alaska is covered by lakes and rivers. In many locations what land surface there is, is very low in elevation and swamplike in the summer. For the present, extensive movement of overland freight cannot take place in the summer by surface means or by large aircraft except through established airports. Transportation problems are much less severe in the early spring months, when the ice sheets and frozen marsh areas will support heavy equipment. Much of the Air Force Cambridge work is directed toward predicting performance on these surfaces.

A project sponsored by the Office of Naval Research, with the writer as the principal investigator, seeks to determine the mechanical properties of ice. This is obviously necessary if rational design is to include strength as well as thermal aspects. Because in Alaska almost all forms of ice and ice mixtures occur near the melting point, their plastic properties become a highly important strength parameter that is very sensitive to temperature. The evaluation of both elastic and plastic mechanical properties by tri-axial shear methods is the objective of the Naval Research ice project.

Included in the ice forms to be studied are the obvious ones of fresh ice and sea ice plus permafrost. When many forms of permafrost are observed, they appear to be a matrix of ice with included organic and mineral particles. From this point of view, the mechanical properties of the material are much more dependent on the ice than on the mineral components.

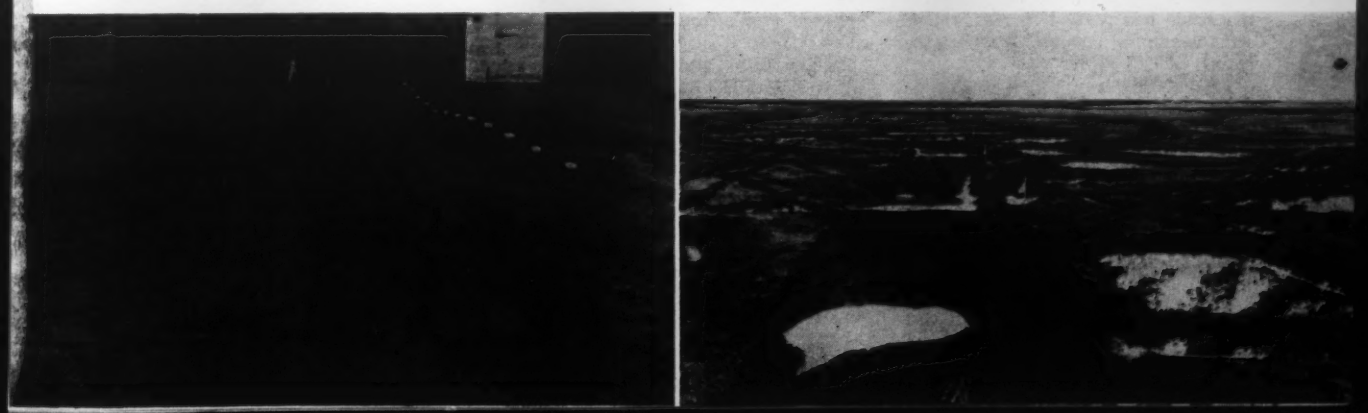
The tri-axial shear results are compared with field strain measurements on floating sheets of fresh and sea ice. The strains are determined at incremental depths by an array of Baldwin-Lima-Hamilton A-9, SR-4 strain gages, which provide a space-strain vector.

Most of the arctic research under way in Alaska (there is much arctic engineering research going on elsewhere) is oriented toward the acquisition of information leading to a rational solution of the few engineering problems peculiar to arctic climates. If the projects are successful, the many forms of ice can be efficiently used as engineering materials to provide a design advantage rather than a handicap.

There are several problems on which little current work is being done. Among the most important of these are water supply and waste disposal. It is hoped that interest in these areas and support for the needed research will be forthcoming.

After repair, this floor slab in a heated Quonset building has undergone a differential settlement of more than 8 in. The total differential settlement since the original floor was placed amounts to about 2 ft.

This road fill, originally about 2 ft above the ground surface, has sunk below it and harbors ponded water that is 3 ft deep in places. The trails on each side indicate that drivers prefer the open tundra to parts of the failed road.



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ALASKA NEEDS ROADS

Line change on Sterling Highway south of Anchorage is seen above during rough grading in May 1957. Note bedded culvert in distance. Completed highway at same location appears at right, in September 1958. Far hills are a part of the Kenai Mountains.

Alaska's 586,000 sq miles are served by about 4,500 miles of road, or about one mile of road for each 100 sq miles. A comparison with the remainder of the nation shows that in the 48 states the average is about a mile of road for each single square mile of area. Alaska's connected road system all lies in the southeast quarter of its main land body, but even in this segment the road density is only one mile for each 25 sq miles.

Low traffic volume, great distances and all kinds of ground conditions plague the highway engineer and administrator in Alaska. Typical volumes on the principal roads are 200 to 500 vehicles per day. Yet in some areas, grading and drainage for a one-lane road may cost $100,000 per mile.

The history of highway development in Alaska parallels that in the other states, except that it has been compressed into a shorter period. At present, road construction has achieved only the stage that was reached elsewhere in the mid-twenties. Highway development in Alaska began with the creation in 1905 of the Alaska Road Commission, an agency of the War Department, composed of Army Engineer officers. Progress over the 27 years of military supervision was slow, with heavy emphasis on the construction of winter trails.

When, in 1932, highway administration passed to the civilian Alaska Road Commission as an agency in the Department of the Interior, there were about 2,200 miles of low-standard roads and about 10,000 miles of trails. None of the roads had a hard surface, though some were good enough for all-weather travel.

Alaska's highway program, dependent as it was on individual annual appropriations for the construction of specified road sections, fared little better under civilian direction than it had under military. World War II, which had a stagnating effect on highway construction elsewhere, gave Alaska its first accelerated highway effort. The Alaska Highway, an epic in heavy construction history, came into existence through a combined military-civilian effort by the United States and Canada. This route gave Alaska its first land transportation link with the United States and, as much as any other single factor, made eventual statehood a reasonable goal. Within Alaska, military requirements during and after the war resulted in substantial appropriations to provide an integrated net of roads. Dustless surfaces were first constructed about 1950.

Perhaps the most notable accomplishment under the Department of the Interior was the establishment of a going "State Highway Department" for the Territory, a step made necessary by the failure of the Territorial Government to develop a highway department of its own. The department, under the Alaska Road Commission, was well organized and equipped, and adequately staffed with 500 to 1,000 employees who dealt successfully with construction, maintenance and administrative problems, which are still unique and still troublesome.

In 1916 the Bureau of Public Roads organized in Alaska a "highway department" responsible for the construction and maintenance of Forest Highways in the Tongass and Chugach National Forests, and for development roads for the Forest Service in Forest areas. The geography and the limited road nets were such that the two federal jurisdictions had only minor overlaps. The Bureau of Public Roads also worked with the Alaska Road Commission during the accelerated programs that followed World War II.

The 1956 Congress transferred to the Bureau of Public Roads the functions, organization and authorities of the Alaska Road Commission, and more important, extended to Alaska in modified form the federal aid for highways that has been the successful basis for highway development in the United States for almost forty years. Under the terms of the legislation, Alaska received about $13.5 millions of federal-aid funds matched with a 10-percent state contribution to provide a $15-million federal-aid program. By special provisions in the law, the federal monies were made available and were used for maintenance of Alaska's federal-aid systems. These funds were in addition to Forest Highway apportionments of about $2.5 million annually and National Park allotments of about a half million a year.

The state has about thirty isolated areas with small road systems that are not connected with other land transportation, and to which, therefore, equipment and men must be taken by water or air. Typically, the smaller of these road nets consists of the road from a settlement to its airfield, its docks, its Indian Service hospital or a military installation. Or the road may connect a mine with deep water. If the situation requires snow removal and the continuous services of one employee, costs may well reach $4000 per mile per year to maintain a road to serve twenty or thirty vehicles. One of the larger of these isolated road nets is that at Juneau, the state capital, where about 60 miles of road serve 3,500 vehicles and about 10,000 persons.

The 10,000 miles of trails in existence in 1932 have almost disappeared. Some have developed into roads, and air travel has replaced the remainder. "Cat" trains still take off across country in the winter, but they make their own trails. These are almost always one-time operations to reach a particular mine or to carry a heavy cargo over frozen ground unsuitable for summer traverse. In the Nome area, the state still contracts for the staking of a few trails each winter for use by the Eskimos under blizzard conditions.

The engineering problems are not too different from those that plague road builders elsewhere. The size of the area

means there is diversity of terrain, of ground cover, and of climatic conditions. The most expensive construction occurs in the panhandle of southeast Alaska, where rugged terrain with fiord-like characteristics is coupled with rain-forest vegetation, muskeg, and 100-in. annual rainfalls to become a construction nightmare. A recent project in the panhandle, to provide grading and drainage for a one-lane road with turnouts, shows a contract cost of $680,000 for 6.7 miles, or about $100,000 per mile. Unit prices included $5,000 per acre for clearing and grubbing and $1.50 per cu yd for unclassified and borrow excavation.

In comparison with southeast Alaska, much of the mainland or "interior" can be traversed over fairly easy topography through broad river valleys and plateau country. For a recent 25-mile project for a graded and drained two-lane road to minimum standards northwest of Fairbanks, the contract cost was about $500,000, or $20,000 a mile. Unit prices included clearing and grubbing at $200 per acre and 85 cents per cu yd for unclassified and borrow excavation. Not all the interior represents easy terrain and low prices. The Chugach (Coast) and the Alaska Ranges must be traversed, and both present serious problems in location.

Highway construction does not require special equipment, and the same earth-moving and compaction equipment found elsewhere will be found in Alaska. Special know-how is required if a contractor is to handle frozen ground successfully, and factors such as isolation, short working seasons, and once-a-year delivery of equipment and materials to job sites must be computed into a successful and profitable operation. Maintenance personnel in Alaska are the world's best improvisors, and nothing is ever discarded. This summer there is being reerected, on a road a hundred miles northwest of Nome, a narrow through-truss bridge that served traffic on the principal street of Fairbanks from the early twenties until last year. En route from Fairbanks to Nome the bridge steel went through Seattle. Such are the vagaries of Alaska transportation.

No discussion of Alaska's highways is complete without a mention of "permafrost," the permanently frozen ground that underlies most of the northern two-thirds of the main land body. There has been extensive and successful research on its control with respect to building construction, in which foundations to be stabilized are minute compared with the area of a highway embankment.

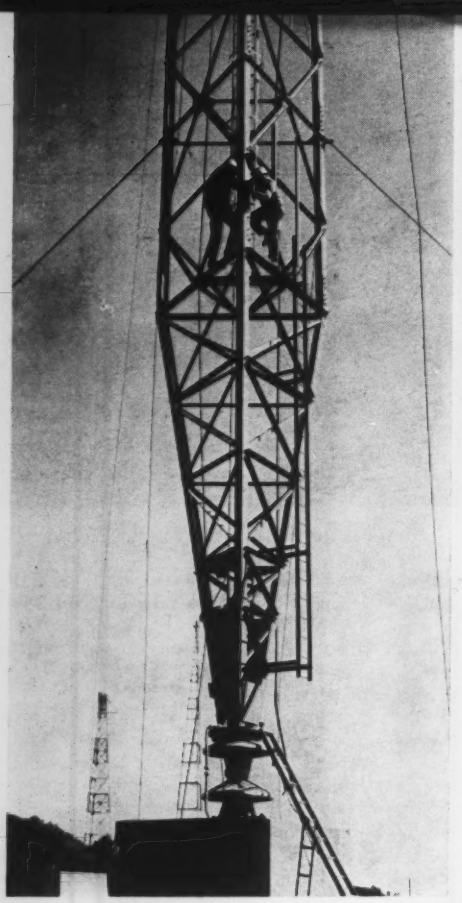
Highway embankments on permafrost deform. All that those who work with it seem to know positively is that good construction techniques give better results than poor practices in permanently frozen ground, just as elsewhere. Major deformations occur on new embankments in the first few seasons and these are anticipated. The discouraging failures are those that occur, without apparent cause, several years after stability is thought to have been reached. The summer of 1958 produced great numbers of such failures, believed to have been caused by a succession of two warm summers separated by a mild winter, with attendant deeper melting of frost and movement of water. Some of the 1958 failures were on embankments with records of essential stability since 1935. Alaska has no "experts" on highway permafrost in its highway organization. Research on the problem will be a continuing activity for a long time to come.

The future of highways in Alaska is uncertain in the sense that all governmental functions in the new state must be reestablished under a new constitution and a new responsibility for self government. The Territory had on its books a reasonably adequate highway and public works act that never became completely operative as regards highways. The new state has a nucleus highway engineering organization but no force to maintain the roads it takes over or builds. Effective with the approval by the President in June of the Alaska Omnibus Act, a major change occurred in Alaska's highway future. With the passing of the Act, the state became a full partner in the federal-aid highway activity. Special provisions which previously had restricted its participation in the program were removed, and its annual apportionment of federal-aid funds jumped from about $14 million to about $36 million. The state's matching requirements increased from about $1.5 million to about $5 million, and federal-aid monies no longer may be used for maintenance, as was permissible under previous enactments.

Operationwise all real and personal property under Bureau of Public Roads ownership was transferred to the state, and the Bureau became a "contract" highway department for Alaska, a relationship which can continue for not to exceed five years. A special grant to the state which may be used for matching purposes and provisions to continue utilization of previously apportioned federal-aid monies for maintenance will provide a greatly extended and fully financed highway program for perhaps three years.

The day of reckoning will come in about three years, when Alaska must face a requirement of about ten million dollars for federal-aid matching and maintenance alone, from tax revenues which will approximate $2 to $3 millions at current rates. Even the immediate future will be a difficult time. There is a real need for expansion of the highway net into the many areas susceptible to development of new resources—be they minerals, oil, forests, or new land for agriculture. Funds for the expansion cannot come at an acceptable rate from current state revenues, although there will be more than adequate federal-aid monies available.

Many other states in the 1925-1935 period, under similar circumstances, converted their resources into bonded indebtedness to accomplish highway expansion. The desire or the ability of Alaskans to bond the state's resources is one of the unknowns at present. It is worth remembering, however, that in this day of throughways and traffic handling complexes, which tax both the engineer and the vehicle operator, there now is a new state that needs thousands of miles of new one-lane, unpaved roads to tap the largest areas in the nation yet unserved by roads of any kind. The admission of Alaska to the Union has considerably enlarged the nation's highway needs, bringing back some of the problems of the past.



The 450-ft tower was "topped out" in only twelve days. Temporary guys have been placed awaiting delivery of the strain insulators. Cost of field erection was reduced by shop welding the 25-ft tapered base section. A crew can be seen checking high-strength bolts above the base section.

HIGH-STRENGTH BOLTS— feature of an Alaska mast

W. J. McFARLAND, JR.

Commander, CEC, USN

Deputy District Public Works Officer

Seventeenth Naval District, Kodiak, Alaska

High-strength bolts, as evidenced by their wide acceptance by the construction industry, are a fast and efficient method of connecting structural steel joints. An important early use of these bolts on a 450-ft-high "radiator," at Kodiak, Alaska, has shown them to be economical and readily adaptable for use in the construction of radio towers and similar structures in remote locations.

The word "radiator" used here describes the electronic characteristics of a radio antenna. The structure to support the radiating features of the antenna is actually a vertical, guyed mast.

Pre-assembly of the mast at the fabricator's yard in Seattle resulted in the structural steel being erected in record-breaking time. The 450-ft tower was "topped out" in only twelve working days, with a maximum of seven workers on the job at any one time.

When the requirements for the radiator were established, it became the responsibility of the District Public Works Officer, Bureau of Yards and Docks, Seventeenth Naval District, to award an architect-engineering contract to produce plans and specifications for the construction of the structure. The contract went to the Leo A. Daly Company, Seattle, Wash., to modify the plans for a similar structure built for

the U.S. Navy in the Philippine Islands, for adaptation to the site and the conditions expected in Alaska.

The accurate analysis of guyed masts, particularly if guyed at more than one level, as required in this case, represents one of the more intricate problems of structural theory. Under wind loadings, the mast represents a continuous beam supported at the base and at the guy points. The wind reactions are resisted by the sets of guys. As the tension in the windward guys increases, their sag decreases, and consequently their chord length increases. (The sag is about one percent for a pretension of about one-eighth of the cable breaking strength.) Conversely, the leeward guys slacken and correspondingly their chord lengths decrease.

One of the most important design criteria in connection with the guyed mast, as indicated above, is the determination of wind loadings. The suggested Navy criteria recommended that the design be made for winds of 120 mph or for winds of 90 mph with a ½-in. ice coating. Some icing is experienced at Kodiak; however, icing conditions are seldom encountered during high winds. On the basis of meteorological data and in the interest of a conservative design, winds of 150 mph were used as the criteria. Velocity pressures were calculated using an area of 1½ times the projected area on one face of the radiator.

Assuming that the mast remains in a straight (vertical) line, the structural analysis for a continuous beam with non-yielding supports is quite simple. The fact that horizontal deflections at the support points (guying points) do occur introduces indeterminate factors. The deflections can be computed only if the wind reactions are known, but the reactions in turn depend on the deflections. The following approximation method is a way of overcoming this difficulty and was used in designing this tower.

1. In determining approximate dimensions of mast and cables it was assumed that there were deflections at the supports.

2. Wind reactions were determined by continuous-beam analysis for non-yielding supports.

3. Guy tensions were determined for these wind reactions.

4. Once the guy tensions were determined, the horizontal deflections were computed.

5. The mast was re-analyzed as a continuous beam with known support settlements by moment distribution or other methods, and then the wind reactions were computed.

6. If these wind reactions were in reasonable agreement with those determined in Step 2, the analysis was satisfactory and the mast could then be designed for the moments, shears, and guy tensions determined.

7. If, on the contrary, the wind reactions from Step 5 differed substantially from those in Step 2, then Steps 3 to 5 were repeated with the new wind reactions until a satisfactory agreement was obtained.

The resulting design provided a structure that is triangular in plan and plane faced vertically except for the 25-ft tapered base section. Normally, the length of this tapered section should be twice the tower's maximum width. This ratio was applied for the Kodiak structure. Diamond-shaped diagonal bracing and horizontal struts were indicated for each panel point. The structural guys were affixed at points 150 and 350 ft above the base insulator. The top loading electronic conductors (radiator guys) were attached 450 ft above the base insulator.

Seismic loading is a factor to consider in the design of structures on Kodiak Island. The northeasterly half of the island, which is of interest here, is located in earthquake Zone 3 (major damage) according to the U. S. Coast and Geodetic Survey. The force to be applied, which is simulated by a series of horizontal forces concentrated at the panel points, is given by the formula, $F = CW$, in which W is the weight in pounds of the part to which the force is to be applied, and C represents the earthquake coefficient determined by the zone and type of structure (0.20 in this instance).

The combination of loading to include earthquake forces is dead load plus one-half the live load plus snow load (a ½-in. coating of ice over the structure). Under this condition a 50-percent increase in allowable working stresses is permitted. For this structure the earthquake loading was not the determining factor (the wind loads were overriding); however, it was important in the design of the foundation.

The specifications required that the structural members for the 25-ft base section and up to and including the first panel point above the base section be shop welded. A change in the design was made after a pre-bid conference, when it was revealed that a galvanizing tank of sufficient size to accommodate the 37.5-ft length did not exist in the Seattle area. The final design provided for welding only the 25-ft tapered base section. Because of the proximity to salt water and the highly corrosive in-

The cribbed area, 8-ft square, indicates the originally designed radiator foundation. In the absence of expected rock, the footings were redesigned to 17 ft 6 in. square. The light colored strata near the surface is a deposit of volcanic ash resulting from the eruption of Mt. Katmai in 1912.

Each high-strength bolt was checked to insure that the bolt axial stress met the specifications. Demonstrating the torque wrench is Al Minugh, Inspector for Western Supply and Equipment Co.

As required by Navy specifications (also required by the Research Council's specifications for dynamically loaded structures), the paint prime coat was removed from the contact surfaces of all structural steel joints.

A splice in a main member of the radiator. This photograph was made after field painting had been completed.

fluences found at Kodiak during the summer months, the specifications required zinc coating for all structural steel after fabrication and shop assembly. Welding and dip galvanizing of the completed unit provided a more durable unit at lower erection cost. Fabrication and construction went to Western Equipment and Supply Company, Seattle.

The connectors for the structural joints under the original design were specified to be structural rib bolts. Immediately after the award of the contract for $349,000 (the final price, including change orders, was $382,843), Guy McGee, Project Manager, proposed to the District Public Works Officer that the contractor be permitted to substitute cadmium-plated high-tensile bolts in lieu of structural rib bolts. The high-strength bolts, while providing a stronger structure, are more expensive than the rib bolts, but there is an economic advantage for the contractor in the ease of field fabrication. The Bureau of Yards and Docks as well as the architect-engineer approved the contractor's proposal.

Erection

After the 25-ft base section had been set in place, erection proceeded with the aid of a basket boom slung inside the tower. As the tower construction proceeded, the boom was raised by the erection crew, utilizing cables connected to a winch at the base of the tower. Each member was completely bolted after being placed. Accurate torquing of the bolts was not attempted at that time. Two hundred barrel pins had been ordered and were on hand for use in lining up the holes in the structural members for bolting.

The pre-erection of the tower's structural members in the fabrication shop in Seattle before shipment paid off. The structural members fitted together so accurately that less than ten barrel pins were used. Temporary guys were utilized at critical locations during the erection to provide added stability. A total of 52 tons of structural steel was erected in 12 days.

Each permanent guy was placed with the aid of two four-part steel blocks and a D-4 tractor. The load was taken up through construction bolts attached to the bridge sockets.

The method of torquing the high-tensile bolts was thoroughly explored. Three methods for tightening the bolts were actively considered.

1. Pneumatic impact wrenches. This method is most effective for a large number of bolts in joints that are easily accessible. The calibrated wrenches not only save considerable time and reduce physical effort, but also introduce simple, yet remarkably effective, bolt-tightening control.

2. Turn-of-nut method. After the fitting-up bolts have been placed to draw the steel members together, the remaining bolts are placed finger tight and then given one full turn. Where the fitting-up bolts are to remain, they should be given an additional one-half turn, or the specifications may require the loosening and then retightening of these bolts. This method is gaining favor in the United States because of its simplicity. (See CIVIL ENGINEERING, January 1958, vol. p. 31.)

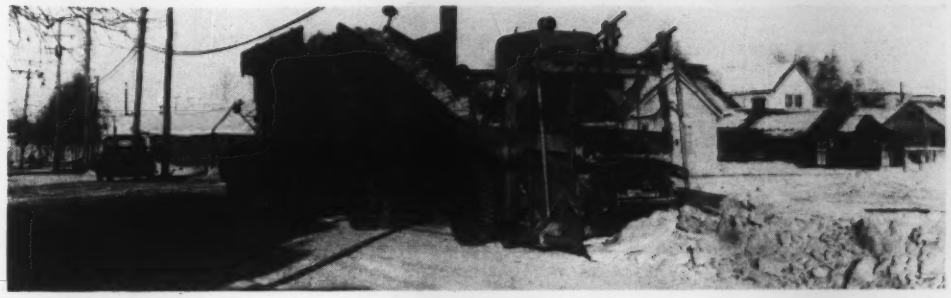
3. Manually operated, calibrated torque wrenches. These wrenches, with a torque gage, are calibrated frequently by strain measurement. The manual installation is most economical when only a few scattered bolts are required at some remote site.

Because of the small number of bolts required at each joint and the cost of transporting equipment from Seattle, the contractor eliminated the first method. The actual installation was made by using the third procedure. The correlation with the turn-of-nut method was gratifying. Erection of the radiator was inspected and all the bolts were checked by a calibrated torque wrench under the direction of the Pacific Testing Laboratory, Seattle, Wash.

The last construction item of interest was the installation of the grounding system. The specifications required that the No. 6, bare, soft-drawn, solid copper radials, 750 ft long, be spaced 1 deg 30 min apart and be buried a minimum of 6 in. The work was started at the end of the construction season. Since the alternate freezing and thawing of the muskeg would not support a tractor of the D-8 type, a Model 40 John Deere tractor, with a cable plow mounted on the yoke, was used. A total of 240,000 ft of the wire was laid in two and a half weeks including 40,000 silver-soldered welds. On one slope where rock was encountered, the wire was stapled with copper staples to the roots of the scrub underbrush.

The future

The present method of designing structural steel joints utilizing high-strength bolts by designing for rivets and substituting equal-size bolts for the rivets is under reconsideration. This procedure does not take advantage of the frictional load-carrying capacity of the bolts. A change in design methods, permitting fewer bolts, would realize further economies and make them more competitive with other construction techniques. Research now under way is expected to result in a change in the specifications so that fewer high-strength bolts will be required in future structures.



ROBERT L. CROW, M. ASCE

Director of Public Works, Fairbanks, Alaska

COLD-WEATHER PUBLIC WORKS

Fairbanks, within the permafrost area of Alaska, has developed interesting means of providing city facilities despite extreme cold. For public works projects, special designs that will operate in a subarctic climate are essential, as well as special equipment and skills for the maintenance of these projects.

A case in point is the sewer system, which is constructed entirely of wood-stave pipe with wood-stave manholes, primarily because of the extremely tough nature of this material and its ability to "give" a little so that it can withstand repeated freezing and thawing without apparent damage. Maintenance of this system in winter requires steam boilers (Cleaver-Brooks are used) mounted on a Ford-truck chassis, which are used to periodically heat up shallow lines and those without sufficient flow to keep them open, and to thaw lines that have frozen.

The design of the water system for Fairbanks required a special study. The result is a system that circulates water constantly through the mains, makes it possible to add heat when required, and, through dual house services, provides for circulation to the heated area of the customer's building. The construction cost for such a system was necessarily extremely high, but water is considered such a basic need that no expense was spared in providing it. Operation of the water system calls for special skills at the treatment plant in order to ensure constant circulation and proper temperatures, and special methods and equipment for the thawing of frozen lines.

Snow removal becomes a special operation only at temperatures below −35 deg F. The belt loaders commonly used for this purpose in many cities become inoperative at the lower temperatures on account of stiffness of the belts, and a rotary plow must be substituted. Starting and operation of all equipment and protection of operators from the cold become difficult when the mercury falls to −50 deg F and lower, and at such temperatures removal operations come to a halt. Fairbanks operates both an Athey belt-loader and a Klauer Sno-Go on a Marmon-Herrington-Ford chassis.

Construction equipment and vehicles used in winter months must be specially equipped with extra lights (because of our very short period of winter daylight) as well as with gasoline-burning personnel heaters and electric engine heaters for prestarting heat. Special lubricants and anti-freeze mixtures must be employed to protect at minus 65 deg F. Natural-rubber inner tubes are necessary in all tires as synthetics deteriorate rapidly in extreme cold. Oversize batteries are commonly provided, and vehicles normally stored out of doors are equipped with trickle-chargers to prevent battery freezing.

In a subarctic area, one of the most difficult times of the year is the spring break-up. During this time, snow melt is extremely rapid, and the frozen ground prevents any penetration of the runoff water, so that floods occur over the greater part of the city. Pumping operations are many and continuous throughout this period. Side effects of the break-up may be seen in frost boils in paved streets, and later seemingly bottomless mud holes in streets both improved and unimproved. The uninitiated feel a false sense of security about the time that warm weather and heavy thawing arrive. Many water and sewer lines suddenly freeze up when it would seem that winter is over.

Construction of surface improvements such as pavements, curbs, and sidewalks is necessarily expensive because of the lack of an adequate base on which to build and the requirement for strength to resist frost heave. High-quality improvements have nonetheless been made in interior Alaska, and modern city streets are beginning to spread rapidly.

Operation and maintenance of public buildings demand careful control of heating plants and other mechanical equipment. Failure of a heating plant in −50-deg weather, even for a very short time, could easily cause the loss of all the mechanical equipment in a building.

An interesting light on subarctic problems is provided by street lighting. The original installation in Fairbanks of mercury vapor lighting, of Westinghouse and Line Materials Co., operated perfectly for several months until the first extremely cold weather arrived. But the ballasts did not permit the units to operate in extreme sub-zero weather, with the result that about 100 units burned out. Fortunately, the manufacturer was able to redesign the ballasts, and replaced all the defective units. Even at the present time, ballasts are only guaranteed to operate down to −40 deg although they generally will operate at −50 deg and colder without a great deal of difficulty.

In many of the operating and maintenance programs of the department, it is necessary to experiment, design special equipment, and make special studies in order to provide the services that are normally provided by municipalities elsewhere.

Engineers who like a challenge and are interested in public works in Alaska should contact the State Department of Highways and Public Works at Juneau and the state employment offices in all the major cities. The experienced public works engineer is in short supply here most of the time.

Uncle Sam's "farthest north" railroad

IRVIN P. COOK, Chief Engineer, The Alaska Railroad, Anchorage, Alaska

The 500-mile Alaska Railroad has been modernized since its use for heavy World War II traffic. New 115-lb AREA rail, on creosoted ties, has replaced the 70-lb ASCE laid when the road was built in 1916-1923. The railroad is completely dieselized.

Unitized cargo boxes are rapidly replacing the standard box-car and refrigerator car. Shippers from West Coast ports place their cargo in these boxes, which measure 9 ft 6 in. x 24 ft in length. The boxes are sealed and shipped by water carrier to the rail head at Seward or Whittier and then loaded, two to a flat car, and forwarded to their destination. There they are picked off by a crane, loaded on trailer trucks and delivered direct to the consignee. This unitizing of cargo handling has resulted in a substantial saving to the shipper, as well as greatly reduced losses from damage and pilferage.

Most of the bridges originally were steel, and little work was required on them in the recent rebuilding program. The 700-ft span crossing the Tanana River is of nickel steel construction and is reputed to be one of the longest simple-span bridges in the world.

One of the greatest hazards of railroading in the subarctic is the overlying non-draining mass of semi-decayed vegetation called "tundra." Tundra varies in depth from one to 10 ft. Because of its affinity for water, a roadbed constructed over it tends to deform with freezing, causing heaves in the subgrade that must be "shimmed" to maintain reliable operating conditions.

The distortion of the roadbed takes place between October and March. It is corrected by placing wood filler blocks, or shims, between the tie plate and the ties. The blocks must be of the right thickness to compensate for the irregularities in the rail surface. The track heaves vary from 1 to 12 in. In a typical year, over 130,000 shims are placed and then removed when frost leaves the roadbed, during the months of April to June.

North of the Alaska Range, or on about one fourth of the total mileage, "permafrost" is encountered and this further complicates the maintenance of a true roadbed surface. Intrusions of permanently frozen ground, dating from the last Ice Age, are thawing at various rates, causing settlements which require filling and resurfacing of track during the summer months to maintain the track surface.

During the winter, moist air from the Japanese Current in the Pacific precipitates in coastal areas, building up a heavy blanket of snow. In a typical year at the military port of Whittier, snowfall of 40 to 50 ft will be recorded and, in extreme years, as much as 70 ft. Snow indicators between Seward and Portage often indicate 10 to 15 ft of snow on the level. At Anchorage the annual snowfall averages about 5 ft. As one progresses north on the railroad, the depth of snow will vary from 10 to 15 ft, and in the Fairbanks region it will decrease to 2 or 3 ft for the annual average.

Rotary snow plows, together with wedge plows, were formerly used extensively to clear the yard and main line of the railroad. However, the development of truck-mounted rotary snow plows and crawler tractors has meant that the snow can be handled more economically and with greater facility.

As the spring season advances, heavy snowfalls in the mountains often form slides that cover the track—to depths of 30 to 40 ft and in lengths up to a half mile—bringing down boulders, trees and assorted debris. These slides are most economically removed by crawler tractors operating in pairs.

With the advent of spring, maintenance forces are increased to take advantage of the Midnight Sun and nearly 24 hours of daylight, enabling the railroad to maintain its speed schedule, which is comparable to that of many stateside railroads. Thus by adapting its procedures to conditions in the north country, the Alaska Railroad is able to maintain a safe and economical transportation system through some of the most spectacular mountain scenery in the world.

Tanana River crossing at Nenana, Alaska, is a 700-ft simple span built with nickel steel. This 40-year-old structure is reported to be the second longest span of its type in the world.

EXPERIMENT and expansion AT THE UNIVERSITY OF ALASKA

CHARLES SARGENT, M. ASCE, Chairman of Engineering, University of Alaska, College, Alaska

With the aim of training engineers who will know the Arctic and be able to cope with its special problems, the University of Alaska has "slanted" its curricula in civil engineering to emphasize arctic and sub-arctic engineering. This university, the only institution of higher learning in our newest state that offers a degree in engineering, has all of its engineering curricula, with the exception of chemical, accredited by the Engineers' Council for Professional Development.

The Department of Civil Engineering, organized when the university was founded in 1922, has become one of the largest departments—largest of all the engineering departments—with an enrollment of about sixty students. The total engineering enrollment is about a hundred students. Six instructors—all of them young and particularly well qualified in their fields—make up the staff of the Civil Engineering Department. The combined staff holds thirteen engineering degrees and four of them were cum laude graduates of their respective colleges. Four of the instructors have received National Science Foundation Faculty Fellowships. Five of them are registered professional engineers in the State of Alaska, and some are also registered in other states. Their mission is three-fold:

1. To instruct engineering students in the fundamental sciences and the engineering sciences necessary for understanding and further study in the engineering discipline.
2. To do research in engineering, particularly in the phases of the science where arctic conditions have the greatest effect.
3. To provide the new state with engineers who are capable of working in the rigorous climate, who can design for arctic conditions and who can manage construction under adverse conditions.

Some experimentation with courses has been carried out, which makes the curriculum somewhat unique. For example, the elementary theory of structures is a sophomore course taken at the same time as elementary mechanics, and preceding mechanics of materials. This permits students to understand such things as shear and moment diagrams, reactions, etc., prior to the study of mechanics of materials. All students in civil engineering are required to study hydrology, advanced surveying, and engineering management and operations. These revisions of the usual curriculum are a concession at the undergraduate level to the requirements of the new state. The curriculum also requires courses in English and in social science to give the engineers as broad a cultural background as possible within the limitations of four years. The curriculum is otherwise very similar to that of any Western state university.

On the graduate level, soil mechanics is taught with emphasis on the included ice as a property of the soil. This is in conjunction with research being carried out at the Arctic Research Laboratory on the fundamental structural properties of ice. Graduate work leading to a masters degree in engineering management is provided, with elective courses in arctic engineering and the arctic aspects of structures.

Future plans of the University of Alaska include a continuation of the rigorous undergraduate program and expansion of the graduate curriculum to include arctic aspects of all branches of the engineering profession. A $2.3 million plant expansion project is under way. Plans are complete and bids asked, for the construction of a $500,000 engineering building. This will be the first stage of a large building program to house all the modern facilities required for the Engineering Division.

It is hoped that research carried on here will eventually provide the engineering profession with the basic knowledge needed for the successful future development of the Arctic.

University of Alaska is located near Fairbanks, almost in the geographical center of the new state. Not shown is the "Composite Building," now under construction at a contract price of $2,363,727, which includes administrative offices and space for the Civil Engineering Department.

Notes on arctic construction . . .

DONALD EYINCK, Land Manager, University of Alaska, College, Alaska

Editor's Note: This article is based on notes compiled by Mr. Eyinck as a surveyor, a site construction superintendent, and chief engineer for Puget Sound-Drake, which gave him an opportunity to visit and work at all the DEW Line sites in Alaska. He is a former city engineer and city manager of Fairbanks.

North of the Brooks Mountain Range in Alaska, water is found generally in its solid rather than its liquid state. Below a depth of perhaps 2 ft, this is the situation the year round, but the surface of the tundra liquefies usually between July and September. The solid state is called permafrost, and is found to extend to depths of 800 to 1200 ft.

From a weather point of view, the region is characterized by a severe climate. It is essentially cold and windy. Ice and snow are on the ground from October through June, so that the winter season is about nine months long. Snow leaves the ground from about June or July through September. However, snow flurries and freezing drizzle can and do occur in July and August. The chief construction season in this region is from March or April to early October.

Weather effects—temperature, wind, relative humidity, precipitation, fog and low overcast—dominate the arctic region. These factors affect flight schedules and the accessibility of particular sites. Spring brings heavy fog as a result of the opening of the ice on the ocean. In the fall, fog is caused by the temperature differential between the land mass and the open water.

Wind is present most of the time and is especially severe from September to early May causing blowing snow and extreme drifting. Winds of 35 to 45 miles per hour cause blowing snow between 10 and 20 ft above the ground. With winds of 60 miles per hour, a generally white condition is found, the snow swirling up from 50 to 100 ft, and visibility being reduced to 50 to 100 ft. In a 60-mile-an-hour wind it is impossible to work outside, and conditions are generally dangerous. Two to four storms of the 60-mile-an-hour type can be expected each winter, and each will last three or four days.

These extreme storms will cause: (1) large, dominant, hard-packed drifts; (2) penetration of snow into any and all cracks; (3) an extreme heat loss from buildings; (4) a very large chill factor, extremely dangerous to human beings; (5) drifting of snow into all vents and openings; (6) a problem with doors since, if care is not exercised, doors will be blown off the hinges or snow will be forced into the hinges. If a door with ice in a hinge is slammed shut, it will be torn loose.

Snow removal is a serious problem in much of this area. The density of hard-packed, wind-driven snow in the arctic makes it close to concrete for support purposes. A D-8 Caterpillar tractor (one of the largest) can drive across the top of 5- to 10-ft drifts without having the cleats penetrate the full depth. When this type of drift is removed by a tractor, a large horizontal force can be transmitted 30 ft or more through the rigid blocks of snow. Careful planning is needed to prevent damage to structures when a tractor is working anywhere near them. And each major storm will bring new snow to replace that removed.

Men and materials

Logistics, a term applied to the job of getting people and material when and where needed, is a major item in arctic construction. The line of supply from the source, usually in the States, is a long one, and considerable time is involved. Planning should be done at least 6 to 12 months in advance and in detail. All material and personnel delivered to the arctic should be of maximum dependability and capable of giving good service under severe conditions.

In a camp or on a construction operation, the services of two people are required for each person actually performing useful work. The added services are for room, board, dry cleaning, provisions, small items, mail handling, water hauling, sewage disposal, and recreation, including games and movies. One of the easiest pitfalls to slip into in an arctic operation is to develop a manpower situation in which a whole group of people are doing essentially nothing except supporting themselves. In this area of great distances and few roads, logistics support by air is a solution that has become essential to the great volume of work in the Arctic.

In the Arctic, "heat balance" is of utmost importance. First, to supply heat costs a great deal of money. Heat that is wasted creates problems. If it goes into the permafrost, it causes instability. If it travels through the walls of a building, it causes frost and condensation in the wall or ceiling, which ultimately result in water damage to the structure. It helps immeasurably in cold areas to follow the rule, "Conserve what is already there—make maximum use of the solid state of water."

Even permafrost has its advantages. As a structural material, with a small percentage of impurities, permafrost ceases to shatter like ice and begins to behave like tough, dense concrete. Experiments in World War II with ice having 4 to 5 percent sawdust frozen in as a slurry, gave a tough, fibrous mass. The presence of the sawdust improved the resistance to heat penetration. It was proposed by the British scientist Geoffery Pyke that this material be used for the construction of emergency-type aircraft carriers. Permafrost has characteristics that are similar to this. It is tough to blast with dynamite and does not come out in expected patterns. But much more study is needed for the full understanding and utilization of permafrost.

Much construction in the Arctic can benefit from a few simple suggestions. Gravel is of first importance. It is needed for roads, where a thickness of 3 ft is required in areas of considerable use and 2 ft elsewhere. Air strips require a minimum gravel thickness of 3 ft and a length of 1,500 ft for the two-engine DC-3 and 3,000 to 4,000 ft for the four-engine DC-4. Permanent airstrips had at least a 5-ft gravel fill. At most construction sites the actual work must be performed on a gravel pad 12 to 24 in. deep to protect the tundra and preserve the permafrost.

The DEW Line (Distant Early Warning Line) is said to be based on a gravel economy. The type of gravel varies from site to site. However, all beach gravel has the same characteristics—rounded, individual particles that do not interlock, with little fine sand, silt or clay fraction for binder. These characteristics are undesirable for compacted material to be used for road and air-strip surfaces or foundations.

However, a gravel that lacks fines will drain and freeze dry so that it can be handled in cold weather.

In some places, gravel is found in almost unlimited quantities while in others it is extremely scarce. The maximum size of this aggregate varies from ¼ or ½ in. at Point Barrow, to 2 or 2½ in. at Barter Island. Where more than 100,000 cu yd of gravel are needed, difficulties are to be expected in finding and hauling it.

Water supply is too often overlooked or regarded as of secondary importance in Alaska construction. Water supply ranks with road and air-strip maintenance as one of the largest items in the successful operation and maintenance of work sites in the country. Water along the coast comes from two basic sources—melted snow or ice and shallow lakes.

At first glance, the melting of snow or ice seems an easy and direct operation. But a very considerable amount of energy is required just to melt ice—to convert water from the solid to the liquid state. A handling analysis shows that a large amount of manpower is needed to cut the ice, drag it to storage, and finally to crush it and melt it for use. This process should be avoided if at all possible.

The lakes along the Arctic coast are shallow. They usually range in depth from 3 to 15 ft; those along the DEW Line in Alaska have an average depth of less than 10 ft. Most are small, ranging in area from 1 to perhaps 80 acres. All are perched on permafrost and have a maximum temperature in summer of about 38 deg F. Chemical analyses of the water show that it varies in quality, but is generally fair to good. However, some of it is very poor. Many of the shallower lakes freeze all the way to the bottom, so that sometimes a long haul of 8 to 15 miles by tractor and tank sled is required to secure water in some areas. Minerals and salts in solution in the water are driven out by freezing and are found strongly concentrated in the fluid left in the bottom of the lake by spring. By April or May, considerable taste and odor may be present—accompanied by large deposits of scale and gunk in boilers and pipes.

Some new ways have been found to alleviate the water problem. One is to gather water in the fall of the year in plastic bags and allow it to freeze. The bags are stacked and later the ice is melted as required. A cost analysis of this method shows that its cost does not differ greatly from that of air freighting water from Fairbanks at a charter rate of $250 per hour for a C-46 aircraft carrying about 11,000 lb (1,500 gal) of water per trip. Another method used is to construct storage tanks of 150,000 to 500,000-gal capacity, depending on the actual needs at the site. The tanks are insulated, and heat exchangers are used if necessary.

The entire arctic region has severe surface drainage problems. It is flat and frozen so that any construction such as a road or air strip can obstruct normal surface runoff. A change in water courses will disturb the permafrost.

Sewage disposal is expensive. Because of the low temperatures and high winds, liquid sewage must be stored in tanks in the buildings and later pumped to insulated and heated tanks on sled-type wanigans. The tanks are hauled to a waste point for dumping.

Wood piling frozen into the permafrost was used for support of the main buildings on the DEW Line. Generally, 16-ft piles were used, frozen in to a depth of 7 ft. Garage and hangar piling was 24 ft in length and frozen in to a depth of 16 ft. Thus, 3 to 4 ft of the piling was left above the ground. Pile caps were placed at this elevation and the building was set on top of these to allow a clear space between the insulated structure and the top of the tundra. This "blow-through" space provides room for natural dissipation of the heat lost from the building and prevents disturbance of the permafrost in which the foundations are set.

Piles were installed by steam thawing a hole in the permafrost or by drilling a hole with an auger. The latter is usually more suitable.

Thawing is done by discharging the steam through a pipe to the tundra, allowing the pipe to move to the depth required as thawing occurs. Because this operation is done when the temperature is from 10 to 35 deg below zero, a considerable amount of steam vapor and fog is produced. The hole developed will have a variable diameter, its shape depending considerably on the operator of the steam point.

Drilling of holes is done with an auger bit on a rack bar about 24 ft long, on a powered drill. This will cut holes to 18 ft in depth and 18 in. in diameter. Generally it is preferable to use the auger, because it is accurate and fast and provides a minimum of heat transfer to the surrounding permafrost, allowing "freezeback" to occur in the shortest practicable time.

The pile is positioned in the hole as close as possible to the vertical, and a mixture of water, slush and drillings from the hole is tamped in. For design purposes, the "ad-freeze" strength which the ice adds to the piling, or ultimately the permafrost to the piling, is calculated at about 7 psi, or 1,000 psf. This means that the average pile installed to a depth of 7 ft will support about 10,000 lb, neglecting point bearing.

Minimum diameter of piling used was 6 in. Of course all piling has to be shipped in as there is no suitable timber in the Arctic. Piles are generally peeled and creosoted under pressure. Treatment is considered desirable but untreated piles have been used in some installations. The very low level of organic activity preserves wood in the Arctic. Friction is not a factor; only the freezing of ice to the piles and the shear strength of the ice is effective.

An example of man-created problems is the case of the collapsing mess halls at one military station. These were a quonset-hut type of construction on a concrete slab installed directly on the permafrost. Waste-water from the kitchen was allowed to drain vertically through a hole in the floor into the permafrost beneath. The heat from the waste-water, combined with that lost through the floor slab, thawed a large cavity under the building, which caused the floor to crack and the building to buckle. A new 40 by 100-ft quonset mess hall was constructed nearby, using identical construction. Waste-water again drained directly into the permafrost. This structure also collapsed, was back-filled and the floor leveled with strongly reinforced concrete, but the discharge of waste-water was allowed to continue. The floor slab again failed, causing buckling and abandonment of the structure. Floor-slab deflection was in excess of 40 in.

A new mess hall was constructed utilizing some of the newly developed principles of arctic construction. The building is in the form of a prefabricated hut, known as MARK 4, with lightweight prefabricated panels of aluminum or magnesium elements. The foundation was constructed with timber sills on the ground, on which short timber posts were set to support the floor, leaving 3 ft of blow-through space between the tundra surface and the bottom of the floor slab for the kitchen and mess hall. Water was disposed of away from the structure. The building has been successful.

Waste-water and sewage drains from structures must be run out sufficiently far from the building foundations and from roads so that any pit created by melting of the permafrost at the outfall will not damage the structures.

In the same area another structure was similarly built but the foundation was not braced to resist horizontal forces. A wind of 70 to 90 mph tumbled the building laterally and completely removed the roof. By the time the storm had abated, two days later,

the building was filled with snow and was no longer usable.

Special attention needs to be given to piling. In one instance, salt water was used as a backfill for piles. It froze from the top down, causing the maximum concentration of salt near the bottom of the piles. Despite the fact that a period of more than a year elapsed between construction and use of the piles, settlement occurred. An investigation showed that lenses of highly concentrated salt water were present along the sides and at the bottom of the piling, the salt concentration being sufficient to prevent freezing at 26 deg F, the temperature that can reasonably be expected in permafrost at that depth.

Surveying in the Arctic requires that the instruments be kept cold. All grease must be removed from working parts to prevent sticking. At temperatures of −25 deg F and lower, the level bubble is short and quite sluggish. The instruments must be kept in a cold place to prevent moisture from getting into the telescopes and obscuring the lenses when temperatures change.

The instrument man must control his breathing to avoid clouding the eye-piece. The procedure is to hold the breath, take a sight, and then exhale some distance from the instrument. In extreme cold, vapor will be emitted from the opening of the parka hood, which can also cause icing on the instrument. At a temperature of −30 deg F in a 20- to 30-mile wind, a surveyor clothed in a parka can do about 1½ to 2 hours of work at a time out on the tundra. Mittens must never be removed. Once heat is lost from the fingers, especially when in contact with cold metal, it cannot be regained except by going inside and thawing them out. Light is a problem. In December, instrument work can be done only from 9:30 to 2:30, and this entire period of daylight should be utilized.

Reference points are very important in a region blanketed under a hard, wind-blown crust of snow. Surveying monuments should be well marked for good visibility. All structures, especially cables, isolated poles, and corners of buildings should be flagged with 1½-ft squares of red cloth on stakes not less than 4 ft long. Important structural elements, such as guy cables and key foundations, must be protected by devices that will help deflect weasels, trucks and tractors. Wood piling of 8-in. minimum diameter, or 6- or 8-in. steel pipe is helpful. Flags must be placed along all roads at regular intervals to give direction during storms, and to make it possible to locate the road or air strip in the drifts that will develop.

Alaska can become a great state

Further comments by Donald Eyinck, Land Manager, University of Alaska, College, Alaska

Now that Alaska has become a state, a great opportunity has been created. This is the last large undeveloped land mass in the United States. It is ready for the enlightened application of planned development. This type of development requires three elements—planning and decision, implemented through action.

A streamlined and strong state government now replaces the "splintered" and weak executive government that existed under territorial status. The number of executive departments has been sharply reduced to provide greater control and more effective action. The new Department of Natural Resources includes the divisions of mines, land, agriculture and development. This provides central authority in the area requiring immediate action—the planned development of Alaska's resources.

The interest of all oil companies was sharply focused on Alaska in July 1957 as a result of the discovery of oil by Richfield Oil, a commercial company, on the Swanson River unit of the Kenai Peninsula. One of the largest oil-leasing booms in the history of the Bureau of Land Management completely swamped both the Anchorage and Fairbanks Land Offices. This major commercial oil discovery was the greatest single event in Alaska's history since the Gold Rush.

By May 1, 1959, the total area covered by oil and gas leases and offers to lease in the state was over 43 million acres. Of the 375 million acres of land in Alaska, over 130 million acres has been classified by the United States Geological Survey as possibly valuable for petroleum production.

The major challenge facing Governor William Egan and the new state government is how to bring the huge land mass of Alaska into productive and positive use in the shortest time at the lowest cost. This will require the application of energy and ingenuity. Think of it for a moment. Here lies an area twice as large as Texas. It is a huge peninsula with a coast line more than twice as long as that of continental United States. It contains two major mountain ranges and several minor ones. Seven major metallogenic provinces have been identified, which contain almost all the economic minerals known to man. Most of the finds to date have resulted from the search for gold in the surface gravels and outcrops. Only recently have the latest techniques of the geoscientists been applied in a patient and scientific manner to a few limited areas.

All the important resources needed to develop this great land of widely divergent topographic areas and climatic regions are present here. The huge hydroelectric potential can be harnessed to provide power in a natural resources development program. The agricultural potential can be developed far beyond its present stage.

Alaska and Northwestern Canada, taken together as a physiographic unit, can be developed to support many millions of the billion-soul increase in the world population of the next generation. We can do this easily by applying the well-established principles of regional planning to Alaska. If this can be done through foreign-aid programs in Japan, Iraq and Turkey, it certainly can be done in the 49th State of the nation that has provided the technical people responsible for such programs throughout the world.

The first step is the preparation of a comprehensive inventory of the natural resources in Alaska and where they are located. Much of this work has already been done, but by many different branches of the federal and territorial governments. Many colleges and universities have developed important information. The information needs to be assembled, centralized, coordinated and supplemented.

The next step will be to digest this inventory and prepare alternative courses of action. The state must look into the future to see what must be done, what can be done, and what might be done. Any plan, to be successful, must have public support and acceptance. It must be kept up to date in this rapidly growing state. A selection of the alternatives must be made in such a way that the course of action to be followed will do the most good for the most people. Positive action will result from a well planned development program. The 49th State will become a great asset to the nation.

AMERICAN SOCIETY OF CIVIL ENGINEERS

1959 Annual Convention

Headquarters, Hotel Statler-Hilton, Washington, D. C. **October 19-23, 1959**

REGISTRATION

Upper lobby, Hotel Statler-Hilton

Opens Sunday, Oct. 18, 2:00 to 5:00 p.m.

Monday, Oct. 19 and each Convention day, 8:30 a.m. to 5:00 p.m.

Registration fee: $5.00 (except women and students.)

HOTEL ACCOMMODATIONS

The Hotel Statler-Hilton, located on 16th St. at K, N.W., will be the official headquarters for this Washington Convention. Special arrangements have been made to accommodate as many as possible at this headquarters hotel. Reservations will be made by the hotel, up to capacity, in the order that reservation requests are received. Send your request early to assure space at the headquarters hotel. For your convenience, a request form is provided on page 23. Late requests will be assigned to nearby hotels.

SESSIONS OUTSIDE THE HOTEL

The National Association of Home Builders has most generously offered the use of its meeting rooms for certain sessions of the Convention expected to exceed the capacity of the headquarters hotel. These rooms are located in the NAHB building on L Street, a half block from the hotel. In this program, such sessions will carry the designation, "Home Builders."

CIVIL ENGINEERING SHOW

9:00 a.m. to 6:00 p.m., Monday through Thursday

9:00 a.m. to noon, Friday

Federal, Congressional Rooms and Upper Capital Terrace

Firms supplying materials, equipment and services used in the various fields of civil engineering will participate in the Third Annual Civil Engineering Show. The exhibit will afford an opportunity to observe at first hand the latest developments available to the practicing engineer.

KICKOFF PARTY

Monday, Oct. 19.

5:30—7:00 p.m. Presidential Ballroom

This first gathering of the Convention will provide an opportunity for meeting, greeting and entertaining friends, with cocktails and hors d'oeuvres.

AUTHORS' BREAKFASTS

New York Room **7:30 a.m.**

Each Convention day, briefing sessions are held for speakers, discussers and program officials only, by invitation.

EUGENE W. WEBER, Chairman of the Technical Program Committee, will preside at these sessions.

ADVANCE INFORMATION ON ATTENDANCE

To ensure preparations for your attendance at the Annual Convention, the Committee requests your assistance. Guidance is needed as to the number of persons that will attend the various functions. Please use the coupon on page 23, which is to be sent to Eugene F. Baldi, Convention Chairman.

This does not constitute registration. It will be necessary to register when you arrive at the Convention.

Do not send a check covering all tickets. The only event for which advance payment is required is the Banquet, on October 21, as explained in the program that follows. Please assist the Planning Committee and return this information form.

LOCAL SECTION CONFERENCE

9:00 a.m.

Monday, Oct. 19 and Tuesday, Oct. 20

MONDAY MORNING

OCT. 19

Highway Division

8:45 a.m. **South American Room**

Presiding: C. E. Fritts, Chairman, Session Programs Committee, Highway Division

8:45 Technical Assistance by Bureau of Public Roads

FRANK C. TURNER, Deputy Commissioner and Chief Engr., U. S. Bur. of Public Road, Washington, D. C.

9:15 General Status of Foreign Highway Improvement

ROBERT O. SWAIN, Executive Director, International Road Federation, Washington, D. C.

9:45 Foreign Highway Standards

BENJAMIN B. TALLEY, Brig. Gen., U. S. Army (Retired), Vice Pres., Raymond International, Inc., New York, N. Y.

10:15 Discussion

Pipeline Division

8:45 a.m. **"Home Builders"**

Presiding: Arthur E. Poole, Chairman, Pipeline Division

8:45 Paper by

J. C. FISHER, Consolidated Edison, New York, N. Y.

9:30 Gas Outage Brings Crisis to Portland, Ore.

E. D. ROWAN, Portland, Ore.

10:15 The Why and How of Underground Storage

RICHARD H. FULTON, Ball Associates, Washington, D. C.

Soil Mechanics and Foundations Division

8:45 a.m. **"Home Builders"**

Presiding: Stanley J. Johnson, Chairman, Soil Mechanics and Foundations Division

8:45 Roadway Embankments Over Unstable River Deposits in District of Columbia

EDWARD J. ZEIGLER, Soils Engr., Associated Consulting Engrs., Baltimore, Md.

9:30 Soil Tests and Observed Movements of Standpipes and Reservoirs

JAMES B. NAUROT

10:15 Sources of Local Soil Information

BONNER S. COFFMAN, Soils Engr., Dist. of Columbia Highway Dept., Washington, D. C.

Structural and Engineering Mech. Divs.—Joint Session

8:45 a.m. Presidential Room

Presiding: D. C. Drucker, Chairman, Engineering Mechanics Div.; C. T. G. Looney, Secretary, Structural Div.; Nicholas J. Hoff, Member, Column Research Council

Joint ASCE and Column Research Council Symposium on a Guide to Design Criteria for Metal Compression Members

8:45 Summary by Column Research Council Chairman

BRUCE G. JOHNSTON, Prof. of Structural Eng., Univ. of Michigan, Ann Arbor

9:05 Basic Column Strength

LYNN S. BEEDLE, Research Prof. of Civil Eng., and L. TALL, Research Assoc., Lehigh Univ., Bethlehem, Pa.

9:55 Effective Length of Framed Columns

THOMAS C. KAVANAGH, Praeger-Kavanagh Engineers, New York, N. Y.

Waterways and Harbors Division

8:45 a.m. Pan American Room

Presiding: Lawrence B. Feagin, Chairman, Waterways and Harbors Division

Session by Committee on Flood Control and Navigation Facilities

8:45 The St. Lawrence Seaway, American Section

M. W. OETTERSHAGEN, Deputy Administrator, St. Lawrence Seaway Development Corp., Massena, N. Y.

9:15 The St. Lawrence Seaway, Canadian Section

L. H. BURPEE, Deputy Chief Engr., St. Lawrence Seaway Authority, Montreal, Canada.

10:00 Waves in Navigation Canals Due to Lock Filling

HANS-WERNER PARTENSCKY, Theodor Rehbock Hydrodynamics Lab., Karlsruhe, West Germany

10:45 Sump Rehandling Dredging Technique—Delaware River

LEWIS CACCESE, Chief, Operations Div., U. S. Army Engr., Dist., Philadelphia, Pa.

It is to be noted that there is a session of the Conditions of Practice Department each day, except Wednesday, at 11:00 a.m. All Technical Division sessions are so planned as to encourage attendance at these Conditions of Practice sessions.

Conditions of Practice Department

11:00 a.m. South American Room

Presiding: John C. Park, Chairman, Committee on Registration of Engineers

Session by Committee on Registration of Engineers

11:00 Present Status of the State Registration Laws

COL. WILLIAM M. SPANN, Tuttle-Ayers-Woodward Co., Kansas City, Mo.

11:35 Proposed Revisions in the Model Registration Law

WILLIAM H. LARKIN, President, National Council of State Boards of Engineering Examiners

NUCLEAR POWER LUNCHEON

Monday, Oct. 19

12:30 p.m. Presidential Ballroom

Invocation

Greetings from the City of Washington D. C.:

BRIG. GEN. A. C. WELLING, Engineer Commissioner of the District of Columbia.

Speaker: HONORABLE JOHN F. FLOBERG, Commissioner, Atomic Energy Commission.

Subject: Nuclear Power

Presiding: FRANCIS S. FRIEL, President, ASCE

Toastmaster: WALTER L. COUSE, Chairman, Executive Committee, Construction Division, ASCE.

All members, guests and friends of ASCE are invited to attend, sharing this topic of such timely concern to the engineering profession and the public at large.

Per plate, $4.25. Tickets for this event must be purchased before 10:00 a.m. on Monday, Oct. 19.

MONDAY AFTERNOON OCT. 19

Construction and Power Divisions—Joint Session

2:30 p.m. "Home Builders"

Presiding: Lyman D. Wilbur, Vice Chairman Construction Division

Nuclear Power Construction Session

2:30 Construction of Dresden Nuclear Power Station

JOHN W. MERRYMAN, Manager of Nuclear Plant Engr., Bechtel Corp., San Francisco, Calif.

3:30 Design and Construction for the Containment of Dynamic Loads

GORDON P. FISHER and WILLIAM MCGUIRE, Assoc. Professors, School of Civil Eng., Cornell Univ., Ithaca, N. Y.

4:15 Nuclear Power Plant Construction in England

JOHN GAUNT

Highway and City Planning Divs.—Joint Session

2:30 p.m. South American Room

Presiding: Norman Kennedy, Chairman, Committee on Urban Transportation, Highway Div.

The Washington Area Transportation Study

2:30 Analysis of Travel Data and Projection of Future Travel

WILBUR S. SMITH, Wilbur S. Smith and Associates, New Haven, Conn.

3:00 Developing and Testing Alternative Urban Transportation Systems

WILLIAM R. MCCONOCHIE, Chief, Traffic and Transportation Sect., DeLeuw, Cather & Co., Chicago, Ill.

3:30 Appraisal of the Facilities Proposed for Mass Transportation

DONALD C. HYDE, General Manager, Cleveland Transit System, Cleveland, Ohio

4:00 Financing and Administering Proposed Transportation System

ROBERT A. KEITH, Project Director, Mass Transportation Survey, National Capital Planning Comm., Washington, D. C.

Pipeline Division

2:30 p.m. "Home Builders"

Presiding: William T. Ivey, member, Executive Committee, Pipeline Division

2:30 Procedures and Operations of Governmental Agencies

3:15 Planning and Research of Florida Line

4:00 Construction of Florida Line

Structural and Eng. Mechanics Divs.—Joint Session

2:45 p.m. Presidential Room

Presiding: Raymond Archibald, Chairman, Committee on Recommended Practice, Column Research Council

ASCE and Column Research Council Symposium

2:45 Lateral Buckling of Beams

JOHN W. CLARK, Asst. Chief, and H. N. HILL, Chief, Eng. Design Div., Alcoa Research Labs., New Kensington, Pa.

3:30 Postbuckling Strength and Effective Width of Plates in End Compression

J. R. JOMBOCK, Research Engr., and JOHN W. CLARK, Asst. Chief, Alcoa Research Labs., New Kensington, Pa.

4:15 Buckling Problems in Plate Girders

K. BASLER, Research Associate, and B. THURLIMANN, Research Prof. of Civil Eng., Lehigh Univ., Bethlehem, Pa.

Waterways and Harbors Division

2:30 p.m. Pan American Room

Presiding: Lawrence B. Feagin, Chairman, Waterways and Harbors Div.

Session by Committee on Coastal Engineering

2:30 Effects of Tidal Inlets on Shore Processes

JOSEPH M. CALDWELL, Chief, Research Div., Beach Erosion Board, Corps of Engrs., Washington, D. C.

3:00 Laboratory Determination of Littoral Drift Rates

RUDOLPH P. SAVAGE, Hydraulic Engr., Research Div., Beach Erosion Board

3:30 Study of Concrete Blocks for Armoring Breakwaters

PIERRE DANEL, General Mgr., with E. CHAPUS and R. DHAILLE, SOGREAH, Grenoble, France.

4:00 Methods of Calculating Stone Sizes for Breakwaters

RAMON IRIBARREN COVANILLES, Prof. of School of Eng. of Roads, Canals and Ports, Univ. of Madrid, Madrid, Spain.

TUESDAY MORNING

OCT. 20

Highway and Construction Divisions—Joint Session

8:45 a.m. South American Room

Presiding: Archie N. Carter, Chairman, Exec. Committee, Highway Division

Problems and Trends in Highway Financing—A Panel

Moderator: Roy E. Jorgensen, Eng. Counsel, National Highway Users Conference, Washington, D. C.

9:00 ELLIS L. ARMSTRONG, Commissioner, U. S. Bureau of Public Roads, Washington, D. C.

9:15 GEORGE M. FOSTER, Exec. Director, Indiana State Highway, Dept., Indianapolis.

9:30 BERNARD HILLENBRAND, Exec. Dir., National Association of County Officials, Washington, D. C.

9:45 PATRICK HEALY, JR., Exec. Director, American Municipal Association, Washington, D. C.

10:00 Discussion to 10:45

Hydraulics Division

8:45 a.m. "Home Builders"

Presiding: J. H. Douma, Hydraulic Structures Committee, Hydraulics Div.

8:45 Dynamic Instability of a Thin Steel Conduit Liner Under Free-Flow Conditions

I. W. MCCAIG, Hydraulic Engr., H. G. Acres and Co., Ltd., Consulting Engrs., Niagara Falls, Ont.

9:30 Unlined Tunnels

J. B. COOKE, J. E. SCHUMANN, and A. G. STRASSBURGER, Engrs., Pacific Gas and Electric Co., San Francisco, Calif.

10:15 Friction Losses in Large-Diameter Concrete-Lined Hydraulic Tunnels

R. L. CLINCH, Senior Project Engr., H. G. Acres and Co., Ltd.

Soil Mechanics and Foundations Division

8:45 a.m. "Home Builders"

Presiding: Jorj O. Osterberg, Vice Chairman, Exec. Committee, Soil Mechanics and Foundations Div.

8:45 Soil and Foundation Problems for the Additional House of Representatives Office Building, Washington, D. C.

GEORGE F. SOWERS, Prof. of Civil Eng., Georgia Inst. of Tech., Atlanta, Ga.

10:00 Old Foundations of the Original Capitol Building

WILLIAM H. MUESER, Partner, Moran, Proctor, Mueser and Rutledge, Consulting Engrs., New York, N. Y.

Structural and Eng. Mechanics Divs.—Joint Session

8:45 a.m. Presidential Room

Presiding: George Winter, Member, Executive Committee, Column Research Council

Joint ASCE and Column Research Council Symposium (continued)

8:45 Effect of Residual Stress on Eccentrically and Laterally Loaded Columns

ROBERT KETTER, Prof. and Head of Civil Eng. Dept., Univ. of Buffalo, Buffalo, N. Y.

9:20 General Instability of Low Framed Buildings

J. E. GOLDBERG, Prof. of Civil Eng., Purdue Univ., Lafayette, Ind.

9:50 Strength and Design of Beam Columns

W. J. AUSTIN, Research Assoc. Prof. of Civil Eng., Univ. of Illinois, Urbana.

Waterways and Harbors Division

8:45 a.m. Pan American Room

Presiding: Lawrence B. Feagin, Chairman, Waterways and Harbors Div.

Session by Committee on Ports and Harbors

8:45 Design and Construction of Navy's Largest Drydock

STANLEY P. ZOLA, Capt., CEC, USN, Officer-in-Charge of Construction, Thirteenth Naval Dist., and PERRY M. BOOTHE, Capt., CEC, USN, Officer-in-Charge of Construction, Puget Sound Naval Shipyard, Bremerton, Wash.

9:30 Analysis and Design of Closure Gates for Drydocks

ARSHAM AMIRIKIAN, Consultant, Bureau of Yards and Docks, U. S. Navy, Washington, D. C.

10:15 Latest Development in Drydocks

H. I. TAYLOR, Commander, CEC, USN, Branch Manager, Ships and Fleet Facilities, Bureau of Yards and Docks.

Conditions of Practice Department

11:00 a.m. **South American Room**

Presiding: Frank L. Weaver, Incoming Chairman, Committee on Engineers in Public Practice

Session of Committee on Engineers in Public Practice

11:00 Activities and Pending Legislation of Interest to the Engineer and Scientist in Government

ROCCO C. SICILIANO, Special Assistant to the President of the United States.

11:40 Contributions of Engineers in Public Practice to the Advancement of Engineering Science

ALFRED R. GOLZE, Assistant Commissioner, U. S. Bureau of Reclamation, Washington, D. C.

ALL ENGINEERS' LUNCHEON

Tuesday, Oct. 20

12:30 p.m. **Presidential Ballroom**

Invocation

Speaker: NATHAN D. DOUGHERTY, Hon. M. ASCE, Dean Emeritus, College of Engineering, Univ. of Tennessee, Knoxville.

Subject: Responsibilities of the Engineer to the Public

Presiding: FRANCIS S. FRIEL, President, ASCE

All members, guests, and friends of ASCE are invited to attend to hear an address, by a noted speaker, that will be of interest to all segments of the civil engineering profession.

Per plate, $4.25. Tickets for this luncheon must be purchased before 10:00 a.m. on Tuesday, Oct. 20.

STUDENT SESSION

11:00 a.m. **"Home Builders"**

Session for students attending the Convention

Presiding: Carl H. Walther, Assoc. Dean of Engineering, George Washington Univ., Washington, D. C.

TUESDAY AFTERNOON

OCT. 20

Construction Division

2:30 p.m. **"Home Builders"**

Presiding: Joseph F. Jelley, Jr., Member, Exec. Committee, Construction Div.

Session on International Construction

2:30 Problems in Managing a World-Wide Construction Program

EUGENE J. PELTIER, Rear Admiral, CEC, USN, Chief, Bureau of Yards and Docks, Washington, D. C.

3:15 The Big Dish

FRANK C. TYRRELL, Captain, CEC, USN, Resident Officer-in-Charge of Construction, U. S. Navy, Bur. of Yards and Docks, Sugar Grove, West Va.

4:15 Building for the Polaris Missile

A. D. HUNTER, Commodore, CEC, USN (Ret.), Consulting Engr. Washington, D. C.

5:00 Deep-Draft Harbor Facilities at Rota, Spain

HAROLD T. CAHILL, JR., Lt. Commander, CEC, USN, Asst. Resident Officer-in-Charge of Construction.

R. C. GORDON, Commander, CEC, USN (Ret.) former ROICC, Area 4, Spain.

Hydraulics Division

2:30 p.m. **"Home Builders"**

Presiding: C. C. McDonald, Chairman, Hydrology Committee, Hydraulics Div.

Session by Hydrology Committee

2:30 Tritium as a Tracer in Water Movement

L. L. THATCHER, Chemist, Research Unit, Quality of Water Branch, U. S. Geological Survey, Washington, D. C.

3:00 Denterium and Its Applications in Hydrology

IRVING FRIEDMAN, Geochemist, Geologic Div., U. S. Geological Survey, Washington, D. C.

3:30 Use of Tracers in the Study of Diffusion in Open-Channel Flow

R. W. CARTER and R. G. GODFREY, Research Section, Surface Water Branch, U. S. Geological Survey, Washington, D. C.

4:00 Use of Stable and Radioactive Tracers in the Movement of Air Masses and Water Vapor in the Atmosphere

LESTER MACHTA, Chief, Special Projects Section, U. S. Weather Bureau, Washington, D. C.

Irrigation and Drainage Division

(Sessions Feature World-Wide Irrigation)

2:30 p.m. **New York Room**

Presiding: N. A. Christensen, Vice Chairman, and Kenneth Volk, Member, Irrigation and Drainage Div. Executive Committee

Session on Irrigation in Pakistan, India and Ceylon

2:30 Irrigation and Drainage in West Pakistan

ROYCE J. TIPTON, Tipton and Kalmbach, Inc., Denver, Colo.

3:00 Irrigation Progress and Problems in India

ALFRED C. INGERSOLL, Prof. of Civil Eng., Calif. Inst. of Tech., Pasadena.

3:30 Irrigation Development in Community Projects, India

SOL RESNICK, Hydrologist, Univ. of Arizona, Tucson.

4:00 Humid Zone Irrigation—Ceylon

PHILIP P. DICKINSON, Technical Asst. to Senator Clair Engle, U. S. Senate, Washington, D. C.

Structural and Eng. Mechanics Divs.—Joint Session

2:45 p.m. **Presidential Room**

Presiding: Theodore R. Higgins, Vice Chairman, Column Research Council

Joint ASCE and Column Research Council Symposium (continued)

2:45 Design of Pony Trusses

E. C. HOLT, Asst. Prof., Rice Inst., Houston, Tex.

3:15 Effect on Floor System Participation on Pony Truss Bridges

R. M. BARNOFF, Asst. Prof. of Civil Eng., Pennsylvania State Univ., University Park, Pa.

3:45 Guide to Design Criteria for Metal Compression Members

BRUCE G. JOHNSTON, Prof. of Structural Eng., Univ. of Mich., Ann Arbor.

Soil Mechanics and Foundations Division

2:30 p.m. **South American Room**

Presiding: Ralph E. Fadum, Member, Executive Committee, Soil Mechanics and Foundations Div.

2:30 Influence of Semi-Pervious Top-Blankets on Relief Wells

REGINALD A. BARRON, Office of Chief of Engineers, Corps of Engineers, Washington, D. C.

3:15 Gas Storage in Water Sands

DOUGLAS BALL

4:00 Geophysics Effects Economy and Efficiencies in Subsurface Exploration

R. WOODWARD MOORE

Waterways and Harbors Division

2:30 p.m. **Pan American Room**

Presiding: Lawrence B. Feagin, Chairman Waterways and Harbors Div.

Session of Committee on Ports and Harbors

2:30 Design and Use of Prestressed Concrete for Marine Structures

BEN C. GERWICK, JR., President, Ben C. Gerwick, Inc., San Francisco, Calif.

3:15 New Deep-Water Port on Pacific Coast of Honduras

NICHOLAS W. PHILIP, Project Engr., Tippetts - Abbett - McCarthy - Stratton, New York, N. Y.

CONSULTANTS' DINNER

Tues., Oct. 20 **Mayflower Hotel**

Annual Dinner of American Institute of Consulting Engineers

6:30 p.m. Cocktails in Chinese Room

7:15 p.m. Dinner in Grand Ballroom

Presiding: George S. Richardson, President, American Inst. of Consulting Engineers.

Cost per person, $19.00.

Engineers who wish to attend may address inquiries to:

American Inst. of Consulting Engrs.
33 West 39th Street
New York 18, N. Y.

4:00 Prediction of Maximum Practical Berth Occupancy

THOMAS J. FRATAR, Partner, with ALVIN S. GOODMAN and AUSTIN E. BRANT, Project Engrs., Tippetts-Abbett-McCarthy-Stratton, New York, N. Y.

WEDNESDAY MORNING
OCT. 21

Annual Business Meeting of ASCE

9:00 a.m. **Presidential Ballroom**

Presiding: Francis S. Friel, President, ASCE

9:00 Annual reports:

By the President

By the Executive Secretary

Awards Luncheon

Wednesday, Oct. 21

12:30 p.m. **Presidential Ballroom**

Invocation

Speaker: MAJOR GEN. EMERSON C. ITSCHNER, Chief of Engineers, U. S. Army

Subject: Registration and Society Participation—Signs of Professional Status

Presiding: Incoming President, ASCE

Toastmaster: VICE ADMIRAL W. O. HILTABIDDLE, JR., Civil Engineer Corps, U. S. Navy (Ret.), President, National Capitol Section, ASCE

Honorary Membership presented to:

HERBERT A. R. AUSTIN, Consulting Engr., Honolulu, Hawaii.

GLEN E. EDGERTON, Major General, U. S. Army (Ret.), recently President and Chairman of the Board, Export-Import Bank of Washington.

JULIAN HINDS, Consulting Engr., Los Angeles, Calif.

FRANK M. MASTERS, Consulting Engr., Harrisburg, Pa.

GUSTAV J. REQUARDT, Consulting Engr., Baltimore, Md.

All members, their wives, guests and friends of ASCE are invited to attend this event.

Per plate, $4.25. Tickets must be purchased before 10:00 a.m. on Wednesday, Oct. 21.

9:30 Presentation of Awards

10:20 Installation of officers

11:00 President's Keynote Address

11:30 Adjournment for Awards Luncheon

WEDNESDAY AFTERNOON
OCT. 21

Eng. Mechanics Division

2:30 p.m. **South American Room**

Presiding: W. Douglas Baines, Chairman Committee on Fluid Dynamics

2:30 Introduction for Task Committee on Mechanics on Stratified Flow by the Committee Chairman

DONALD R. F. HARLEMAN, Assoc. Prof., Dept. of Civil and Sanitary Eng., Mass. Inst. of Tech., Cambridge.

3:00 Stratified Flow Into a Line Sink for a Linear Density Gradient

WALTER R. DEBLER, Dept. of Eng. Mechanics, Univ. of Michigan, Ann Arbor.

3:30 Irrational Motion of Two Fluid Strata Towards a Line Sink

GRANT HUBER, Assoc. Prof. of Mechanical Eng., McMaster Univ., Hamilton, Ont.

4:00 Internal Waves in a Stratified Fluid—a General Review

GARBIS H. KEULEGAN, Physicist, Fluids Mechanics Sect., National Bur. of Standards, Washington, D. C.

Irrigation and Drainage Division

2:30 p.m. **New York Room**

Presiding: William W. Donnan, Secretary, Irrigation and Drainage Div.

World-Wide Irrigation (continued)

Irrigation in Iraq, South Africa, Australia and New Zealand

2:30 Irrigation and Drainage in South Africa, Australia and New Zealand

MARTIN R. HUBERTY, Dir., Univ. of Calif., Water Resources Center, Los Angeles, Calif.

3:15 The Heritage of Irrigation in Iraq

M. R. LEWIS, Irrigation Engr., Carroll E. Bradbury and Assocs., Los Altos, Calif.

4:00 Irrigation Systems of the Tigris and Euphrates Valleys in Ancient and Modern Times

STANLEY S. BUTLER, Assoc. Prof. of Civil Eng., Univ. of Southern Calif., Los Angeles.

Pipeline Division

2:30 p.m. **"Home Builders"**

Presiding: Robert E. Kling, Program Chairman, Pipeline Division

Sanitary Engineering Division

2:30 p.m. **Pan American Room**

Presiding: Stanley E. Kappe, Chairman, Sanitary Engineering Division, National Capital Section

Session on High-Rate Sewage Sludge Digestion

2:30 Fundamental Considerations

CLAIR N. SAWYER, Assoc., and JAY S. GRUMBLING, Research Engr., Metcalf and Eddy, Boston, Mass.

3:00 Design and Cost Considerations

ALFRED A. ESTRADA, Vice President, Albright and Friel, Inc., Engrs. Philadelphia, Pa.

3:30 Operation Experiences in Columbus, Ohio

JAMES H. BLODGETT, Supt., Sewage Treatment Works, Columbus, Ohio.

4:00 Experimental Installations at District of Columbia Sewage Treatment Plant

HUGH A. SCHREIBER, Supt., Sewage Treatment Plant, Washington, D. C.

Structural Division

2:45 p.m. **Presidential Room**

Presiding: R. A. Hechtman, Chairman, Committee on Session Programs, Structural Div.

Session on Composite Design in Building Construction

2:45 Development of Tentative Recommendations for Design of Composite Beams and Girders in Buildings

P. P. PAGE, JR., Assoc., Seelye, Stevenson, Value and Knecht, Consulting Engrs., New York, N. Y.

3:15 Review of Past Research

F. J. HANRAHAN, Exec. Vice Pres., Amer. Inst. of Timber Construction; N. W. HANSON, Development Engr., Portland Cement Assoc., Skokie, Ill.; and I. M. VIEST, Bridge Research Engr., AASHO Road Test, Highway Research Board, Ottawa, Ill.

3:45 Composite Designs in Concrete and Steel

AARON GARFINKEL, Partner, Garfinkel and Marenberg, Consulting Engrs., New York, N. Y.

4:15 Composite Designs in Precast and Cast-in-Place Concrete

A. R. ANDERSON, Partner, Anderson, Birkeland and Anderson, Structural Consultants, Tacoma, Wash.

Surveying and Mapping Division

2:30 p.m. **"Home Builders"**

Presiding: Earle J. Fennell, Vice Chairman, Surveying and Mapping Division

2:30 Surveying and Mapping Problems of Our 49th and 50th States—A Panel

Moderator: ROBERT H. RANDALL, Asst. on Cartography, Bureau of the Budget, Washington, D. C.

Panelists: FRANKLIN K. VAN ZANDT, U. S. Bureau of Land Management, Washington, D. C.; REYNOLD E. ISTO, U. S. Geological Survey, Fairbanks, Alaska; LANSING G. SIMMONS, U. S. Coast and Geodetic Survey, Washington, D. C.; JAMES M. DUNN, Surveyor, Hawaii Survey Dept., Honolulu, Hawaii.

3:45 Military Requirements for Topographic Maps

FREDERICK O. DIERCKS, Col., U. S. Army, Commanding Officer, Army Map Service, Washington, D. C.

4:15 Civil Requirements for Topographic Maps

ROBERT H. LYDDAN, Asst. Dir., U. S. Geological Survey, Washington, D. C.

BANQUET AND RECEPTION

Wednesday, Oct. 21

6:30 p.m. Assembly and cocktails In Foyer 3, South American and California Rooms

7:30 p.m. Banquet in Presidential Ballroom

9:00 p.m. Reception by President and Honorary Members

For this event, special reservations can be made for tables seating 10 persons each. Members may underwrite complete tables, or pool reservations with others.

The published seating list will close at 2:00 p.m., Tues., Oct. 20. Tickets purchased after that hour will be assigned to tables in order of purchase. Sale of tickets will be limited to the capacity of the Presidential Ballroom.

Dinner dress (black tie). Per plate $10.00.

Mail orders for tables must be accompanied by a check in full, payable to the American Society of Civil Engineers, and a list of guests. Send order and checks to:

American Society of Civil Engineers
33 West 39th St.
New York 18, N. Y.

THURSDAY MORNING

OCT. 22

Highway and City Planning Divs.—Joint Session

8:45 a.m. **South American Room**

Presiding: Wilbur S. Smith, Chairman, Committee on Traffic Engineering, Highway Div.

8:45 Traffic in Urban Redevelopment

DAVID M. WALKER, Commissioner, Urban Renewal Admin., Housing and Home Finance Agency, Washington, D. C.

9:15 Major Highways in the Urban Network

WILLARD F. BABCOCK, Director, State Highway Commission, Raleigh N. C.

9:45 Toll Facilities in the Modern Highway Program

CHARLES L. DEARING, Illinois Toll Highway Commission, Chicago.

10:15 Land Use and Expressways

FRED W. TUEMMLER, Fred W. Tuemmler & Associates, Community Planning and Development Consultants, Hyattsville, Md.

Air Transport Division

8:45 a.m. **New York Room**

Presiding: John M. Kyle, Jr., Chairman, Air Transport Division

8:45 Application of Airphoto Interpretation Techniques to Airfield Engineering

JAMES H. MCLERREN, Asst. Chief, Photographic Interpretation, Research Branch, Corps of Engineers, SIPRE, Wilmette, Ill.

9:15 Use of Aerial Photography in Arctic and Subarctic Engineering

ROBERT E. FROST, Supervising Civil Engr., Photographic Interpre-

tation, Research Branch, Corps of Engineers, SIPRE, Wilmette, Ill.

10:00 Contributions of U. S. Coast and Geodetic Survey to Air Transport

B. H. SHERIDAN

Hydraulics Division

8:45 a.m. **"Home Builders"**

Presiding: Emmett M. Laursen, Member, Hydromechanics Committee, Hydraulics Division

Session by Hydromechanics Committee

8:45 Measurements in Hydraulic Models

JOHN F. RIPKIN, Prof. of Hydromechanics, Univ. of Minnesota, Minneapolis.

9:15 Model Studies with Reynolds Number as a Main Concern

W. P. SIMMONS, Hydraulic Engr., Bur. of Reclamation, Denver, Colo.

9:45 Model Studies with the Froude Number as a Main Concern

REX A. ELDER, Head, Hydraulic Operations and Tests Section, Tennessee Valley Authority, Norris, Tenn.

10:15 Fixed-Bed River Models

J. E. FOSTER, Chief, Operations Sect., Mississippi Basin Model, Waterways Experiment Station, Vicksburg, Miss.

Power Division

8:45 a.m. **Pan American Room**

Presiding: John F. Bonner, Chairman, Exec. Committee, Power Division

8:45 Engineering and Operating Problems Peculiar to Navy Industrial Power Plants

L. F. DEMING, Head, Power Generating Sect., Bureau of Yards and Docks, Dept. of the Navy.

9:15 Pumped Storage Opportunities in Hydroelectric Engineering

ADOLPH J. ACKERMAN, Consulting Engr., Madison, Wis.

9:45 More Power to Puerto Rico

EDWIN T. MORRIS, Vice President, Raymond International, Inc.

10:15 An Engineer-Constructor's Role in World-Wide Power Expansion

JOHN P. BUEHLER, Manager, Hydro-Electric Power, Bechtel Corp.

SANITARY ENG. DIVISION INSPECTION TRIP

Inspection of Sewage Treatment Plant, District of Columbia

9:00 a.m. Bus departs from Statler Hotel.

11:15 a.m. Bus leaves plant for return to hotel.

Structural and Eng. Mechanics Divs.—Joint Session

8:45 a.m. **Presidential Room**

Presiding: Robert D. Dewell, Member, Executive Committee, Structural Div., and Dan H. Pletta, Vice Chairman, Executive Committee, Engineering Mechanics Div.

Session on Lightweight Metals

8:45 Welded Aluminum Bridges for Military Traffic

F. J. TAMANINI, Chief, Bridge Branch; and WENDELL KEYES, Senior Project Engr., Bridge Branch, U. S. Army Engineer Research and Development Lab., Fort Belvoir, Va.

9:15 Tests of Composite Aluminum and Concrete Highway Bridge

S. J. ERRERA, Engineer of Tests, and H. MINDLIN, Research Asst., Lehigh Univ., Bethlehem, Pa.

9:45 Design of Welded Aluminum Structures

H. N. HILL, Chief, JOHN W. CLARK, Asst. Chief, and R. J. BRUNGRABER, Research Engr., Design Div., Alcoa Research Labs., New Kensington, Pa.

10:15 Strength of Welded Aluminum Columns

R. J. BRUNGRABER, and JOHN W. CLARK, Design Div., Alcoa Research Labs., New Kensington, Pa.

Conditions of Practice Department

11:00 a.m. **South Amer. Room**

Presiding: Waldo G. Bowman, Chairman, Department of Conditions of Practice

Session of Committee on Employment Conditions

11:00 What ASCE Is Doing to Improve Employment Conditions for Its Members

R. K. LOCKWOOD, Civil Engr., Sika Chemical Corp., Passaic, N. J.

11:20 Trends in Employment Conditions as Indicated by the 1953 and 1958 Surveys

CHARLES W. GRIFFIN, JR., Allabach and Rennis, Inc., Philadelphia, Pa.

11:40 Trends in Employment Conditions as Related to Engineers in Public Practice

IRVING F. ASHWORTH, Chief, Office of Technical Controls, Dept. of City Planning, New York, N. Y.

GENERAL MEMBERSHIP LUNCHEON

Thursday, Oct. 22

12:30 p.m. **Presidential Ballroom**

Invocation

Speaker: MARK D. HOLLIS, Asst. Surgeon, General and Chief Engineer, U. S. Public Health Service.

Subject: The Future Is Now

Presiding: Newly installed President, ASCE

Toastmaster: LEWIS A. YOUNG, Vice Chairman, Exec. Committee, Sanitary Eng. Division.

All members, guests and friends of ASCE are invited to attend this luncheon to hear the Chief Engineer of the Public Health Service discuss some engineering problems relating to health, including nuclear contamination.

Per plate, $4.25. Tickets for this event must be purchased before 10:00 a.m. on Thursday, Oct. 22.

THURSDAY AFTERNOON OCT. 22

Eng. Mechanics and Structural Divs.—Joint Session

2:45 p.m. **Presidential Room**

Presiding: E. F. Masur, Chairman, Committee on Mathematical Methods, Eng. Mechanics Div.

2:45 Cold-Formed, Light-Gage Steel Structures

GEORGE WINTER, Head, Dept. of Structural Eng., Cornell Univ., Ithaca, N. Y.

3:15 Some Stability and Minimum-Weight Considerations for Thin-Gage Metal Structures

GEORGE GERARD, Asst. Director,

Research Div., New York Univ., New York, N. Y.

3:45 Behavior of Buckled Rectangular Plates

MANUEL STEIN, Aero. Research Engr., Structures Research Div., NASA, Langley Field, Va.

4:15 Vibrations and Stability of Plates Under Initial Stress

G. HERMANN, Prof. of Civil Eng., Columbia Univ., and A. ARMENAKAS, Associate Prof., Cooper Union, New York, N. Y.

Construction Division

2:30 p.m. "Home Builders"

Presiding: Walter L. Couse, Chairman, Executive Committee, Construction Div.

Session on Construction Management

2:30 Double Jeopardy in Performance and Payment Bonds

ROBERT A. MOYER, Chas. H. Tompkins Co., Washington, D. C.

3:15 World-Wide Construction Safety Activities

ROBERT G. JENKINS, Chief of Safety, U. S. Corps of Engrs., Washington, D. C.

4:00 Current Competitive Conditions

ANCLE TESTER, John Tester & Son, Inc., Clinton, Md.

4:45 Recruitment of Young Engineers

JOHN E. HEALY, II, John E. Healy & Sons, Wilmington, Del.

Irrigation and Drainage Division

2:30 p.m. New York Room

Presiding: John H. Bliss, Vice Chairman Executive Committee, Irrigation and Drainage Div.

Session on Irrigation in Europe, Central and South America

2:30 Irrigation in Honduras, Dominican Republic and Puerto Rico

L. S. WILLARDSON, Agricultural Engr., U. S. Dept. of Agriculture, Logan, Utah.

3:00 Drainage and Water Management in Western Europe

WILLIAM W. DONNAN, Drainage Engr.; Agricultural Research Service, Pomona, Calif.

3:30 Irrigation and Drainage Projects in Uruguay

J. E. CHRISTIANSEN, Prof. of Civil Eng., Utah State Univ., Logan.

4:00 World Practices in Water Measurement and Control at the Farm Turnout

CHARLES W. THOMAS, Hydraulic Engr., Bur. of Reclamation, Denver, Colo.

Power Division

2:30 p.m. Pan American Room

Presiding: Francis L. Adams, Chairman, Program Committee, Power Div.

2:30 Exporting American Engineering Experience

ARTHUR T. LARNED, Assoc. Consulting Engr., Ebasco Services, Inc., New York, N. Y.

3:00 Technical Assistance to Foreign Countries by Bureau of Reclamation

ALFRED R. GOLZE, Asst. Commissioner, Bureau of Reclamation.

3:30 Design of the Karadji Dam Project

BRUCE M. JOHNSON, Project Engr., and RICHARD D. HARZA, Civil Engr., Harza Engineering Co., Chicago, Ill.

4:00 Influence of Load Growth on Hydroelectric Possibilities

STANFORD P. MCCASLAND, Chief Hydroelectric Engr., Ebasco International.

Sanitary Engineering Division

2:30 p.m. "Home Builders"

Presiding: Frank A. Butrico, Vice Chairman, Sanitary Engineering Div., National Capital Section

Session on Water Resources

2:30 Water Resources Planning of Interest to Sanitary Engineers

CARTER PAGE, Chief, Planning Div., Civil Works, Office of Chief of Engrs., Washington, D. C.

3:00 World-Wide Water and Sewage Requirements Confronting the U. S. Air Force

JOHN E. KARUZA, Consulting Civil Engr., U. S. Air Force, Washington, D. C.

3:30 World-Wide Water Development Program

H. G. BAITZ, Director, Div. of Environmental Sanitation, World Health Organization, Geneva, Switzerland; HAROLD R. SHIPMAN, Sanitary Engr., Chief, Branch of Environmental Sanitation, World Health Organization, Washington, D. C.; and LEONARD BOARD, Sanitary Eng. Adviser, Public Health Div., International Cooperative Admin., Washington, D. C.

4:00 Relationship of Hydrology to Water Supply and Waste Water Planning

PAUL C. BENEDICT, Chief, Research Sect., Quality Water Branch, U. S. Geolog. Survey, Washington, D. C.

Surveying and Mapping Division

2:30 p.m. South American Room

Presiding: Earle J. Fennell, Vice Chairman Surveying and Mapping Div.

2:30 Land Subsidence Over Large Areas as Shown by High-Order Leveling

JOHN H. BRITTAIN, Capt., U. S. Coast and Geodetic Survey, Washington, D. C.

3:00 New Tellurometer Systems

FLOYD W. HOUGH, Consulting Geodetic Engr., Geonautics, Inc., Washington, D. C.

3:30 Implementation on Status of Surveying and Mapping Profession—a Panel

Moderator: JAMES A. COTTON, Consulting Engr., Dallas, Tex.

Panel: BROTHER B. AUSTIN BARRY, Assoc. Prof. of Civil Eng., Manhattan College, New York, N. Y.; ALFRED O. QUINN, Chief Engr., Aero Service Corp., Philadelphia, Pa.; GEORGE D. WHITMORE, Chief Topographic Engr., U. S. Geological Survey, Washington, D. C.

PAN AMERICAN FIESTA

Thursday, Oct. 22

8:30 p.m. Pan Amer. Union Bldg.

A gala evening, with Latin American music and entertainment, refreshments, and a chance to chat with friends and business associates.

Transportation furnished from hotel and return

Per person $3.50, per couple $6.00

FRIDAY MORNING

OCT. 23

Air Transport Division

8:45 a.m. "Home Builders"

Presiding: John M. Kyle, Jr., Chairman, Air Transport Div.

8:45 Design and Construction of Asphalt Pavement Structures

D. D. Woodson, Asphalt Inst., College Park, Md.

9:15 Construction of Concrete Airfield Pavements

Gordon K. Ray, Portland Cement Assoc., Chicago, Ill.

9:45 Reinforced Concrete Pavements for Airports

A. W. Compton, Clyde E. Williams and Assocs., Indianapolis, Ind.

10:15 Construction of Prestressed Concrete Test Pavement

Carl F. Renz, Chief, Structural Branch, Ohio River Div. Labs., U. S. Army Engrs., Cincinnati, Ohio.

City Planning Division

8:45 a.m. **South Amer. Room**

Presiding: J. Cal Callahan, Chairman, City Planning Div.

Civil Defense and Defense Mobilization

Moderator: Lewis E. Berry, Asst. Director in Charge of Operations, Office of Civil and Defense Mobilization

Panel:

John J. Maginnis, Deputy Asst. Director, Shelter and Vulnerability Reduction.

Eugene J. Quindlen, Deputy Asst. Director, Federal, State and Local Plans.

Charles K. Shafer, Director of Meteorological Office.

Paul C. McGrath, Deputy Director, Intelligence and National Security Affairs Office.

Engineering Mechanics Division

8:45 a.m. **Presidential Room**

Presiding: R. J. Hansen, Chairman, Committee on Structural Dynamics, Engineering Mechanics Div.

Session on Structural Dynamics

8:45 Dynamic Elastoplastic Response of Rigid Frames

F. L. Di Maggio, Asst. Prof. of Civil Eng., Columbia Univ., New York, N. Y.

9:30 Dynamic Effect of a Moving Load on a Rigid Frame

Robert C. De Hart, Manager, Structural Mechanics Sect., Southwest Research Inst., San Antonio, Tex.

10:15 Effect of End Fixity on the Vibration of Rods

D. Burgreen, Eng. Adviser, Nuclear Development Corp., White Plains, N. Y.

Hydraulics Division

8:45 a.m. **"Home Builders"**

Presiding: L. P. Disney, Chairman, Tidal Hydraulics Committee, Hydraulics Div.

Symposium on Circulation in New York Harbor Sponsored by Tidal Hydraulics Committee

8:45 Field Studies of the Circulation Pattern

H. B. Stewart, Jr., Asst. to the Chief, Tides and Currents Div., Coast and Geodetic Survey, Washington, D. C.

9:30 Aspects of Circulation Revealed by Model

Eugene P. Fortson, Jr., Chief, Hydraulics Div., and Henry B. Simmons, Chief, Estuaries Sect., Waterways Experiment Station, Vicksburg, Miss.

10:15 Utilization of Observations of Circulation on Salinity Distribution in Prediction of Dispersion of an Introduced Pollutant

D. W. Pritchard, Director, Chesapeake Bay Inst., Baltimore, Md.

Power Division

8:45 a.m. **Pan American Room**

Presiding: George R. Standberg, Member, Exec. Committee, Power Div.

8:45 Civil Engineering Features of Thermal Electric Plants Built Overseas

Alexis Ł. Bluckman, Supervising Structural Engr., Gibbs and Hill, Inc.

9:15 Rehabilitation of Hwachon Dam and Power Plant in Korea

R. E. Hollick, Head, Structural Sect., International Eng. Co., Inc., San Francisco, Calif.

9:45 Sariya Hydroelectric Project

A. E. Eckberg, Project Engr., Charles T. Main, Inc., Boston, Mass.

10:15 Thermal Electric Stations in Japan

R. T. Richards, Civil Engr., Ebasco Services Inc., and Tokyo Electrical Power Co.

Conditions of Practice Department

11:00 a.m. **South American Room**

Presiding: Waldo G. Bowman, Chairman, Dept. of Conditions of Practice

Session of Committee on Engineering Education

What the Federal Government Is Doing for Engineering Education

11:00 Engineering Manpower and the U. S. Office of Education

Henry H. Ormsby, Chief of Engineering Education, Div. of Higher Education, Office of Education, Washington, D. C.

11:30 National Science Foundation Programs Related to Engineering Education

Bowen C. Dees, Deputy Asst. Director for Scientific Personnel and Education, National Science Foundation, Washington, D. C.

STATE PLANNING AND CIVIL DEFENSE LUNCHEON

Friday, Oct. 23

12:30 p.m. **Presidential Ballroom**

Invocation

Speaker: Hon. Cecil H. Underwood, Governor of West Virginia

Subject: Planning for West Virginia

Presiding: Newly installed President, ASCE

Toastmaster J. Cal Callahan, Chairman, Executive Committee, City Planning Division.

Here is an informed and interesting speaker on a subject of interest to the civil engineer in particular. All members, guests and friends of ASCE are invited to attend.

Per plate, $4.25. Tickets for the luncheon must be purchased before 10:00 a.m. on Friday, Oct. 23.

FRIDAY AFTERNOON OCT. 23

Air Transport Division

2:30 p.m. **"Home Builders"**

Presiding: John M. Kyle, Jr., Chairman Air Transport Div.

2:30 Preliminary Studies of Stress Under Off-Road Vehicles

S. J. Knight, Chief, Trafficability Sect., and J. E. Green, Waterways Experiment Station, Vicksburg, Miss.

3:00 Taxiing Problems Associated with Runway Roughness

B. Milwitsky or J. C. Houbolt, NASA, Langley Air Force Base, Va.

3:30 Epon Asphalt Concrete for Airfield Pavements

W. C. SIMPSON, H. J. SOMMERS, R. L. GRIFFIN, T. K. MILES, Shell Development Co., Emeryville, Calif.

4:00 Dynamic Testing of Pavements

W. HEUKELOM, Koninklijke/Shell-Laboratorium, Amsterdam; and CHARLES R. FOSTER, Chief, Flexible Pavement Branch, Waterways Experiment Station, Vicksburg, Miss.

Engineering Mechanics Division

2:45 p.m. **Presidential Room**

Presiding: John S. Archer, Chairman, Committee on Experimental Analysis and Analogs.

Session on Analysis of Highly Redundant Structures by Experimental and Analog Techniques

2:45 Electronic Models for Structural Vibrations with Elastic-Plastic Couplings

H. M. PAYNTER, Dir., American Center for Analog Computing, Boston, Mass.

3:15 Aircraft Structural Analysis with the Electric Analog Computer

W. J. BRIGNAC, Project Structures Engr., and R. G. SCHWENDLER, Senior Structures Engr., Convair, Fort Worth, Tex.

3:45 Arch Dam Analysis with the Electric Analog Computer

R. H. MACNEAL, Eng. Service Div. Manager, Computer Engineering Assocs., Pasadena, Calif.

4:15 Elastic Model Design of the B-58 Airplane Structure

J. W. WELLS and H. B. ENGLAND, Senior Structures Engrs., Convair, Fort Worth, Tex.

Power Division

2:30 p.m. **Pan American Room**

Presiding: Marcel P. Aillery, Vice Chairman, Exec. Committee, Power Div.

2:30 Design of Power Plants for Naval Shore Establishments

W. S. FORESMAN, Bur. of Yards and Docks, Dept. of the Navy.

3:00 Design of Furnas Hydroelectric Project

J. W. LIBBY, Chief Design Engr., International Eng. Co., Inc., San Francisco, Calif.

3:30 Piratininga Station of Sao Paulo Light

H. M. ESTES and O. L. HOOPER, Stone and Webster Eng. Corp., Boston, Mass.

4:00 Civil Engineering Features of the Regla Steam Electric Station

GEORGE T. INGALLS, Ebasco International Corp., New York, N. Y.

City Planning Division

2:30 p.m. **South Amer. Room**

Presiding: J. Cal Callahan, Chairman, City Planning Div.

Panel Discussion on State Planning and Civil Defense

2:30 Panel:

Essential Requirements for Civil Defense

LEWIS E. BERRY, Asst. Director in Charge of Operations, Office of the President, Office of Civil and Defense Mobilization.

The Basic Function of Transportation

JOHN M. KOHL, Director, Transportation Inst., Univ. of Michigan, Ann Arbor.

4:00 Problems of Water Supply in a Nuclear Age

DONALD A. PECSOK, Senior Sanitary Eng., Div. of Radiological Health, U. S. Health Service.

Sanitary Engineering Division

2:30 p.m. **"Home Builders"**

Presiding: Conrad P. Straub, Chairman, Committee on Sessions Programs, Sanitary Engineering Div.

Session on Metropolitan Problems

2:30 Sanitary Engineering Aspects of Metropolitan Problems

WESLEY E. GILBERTSON, Chief, Div. of Eng. Services, U. S. Public Health Service, Washington, D. C.

2:50 Washington Metropolitan Cooperation in Pollution Control

DAVID V. AULD, Dir. of Sanitary Eng., Dist. of Columbia Health Dept., Washington, D. C.

3:10 Water and Sewage Requirements for Metropolitan Washington

GILBERT V. LEVIN, Sanit. Engr., Resources Research, Inc., Washington, D. C.

3:30 Progress in Radioactive Waste Control

A paper prepared by the Committee on Sanitary Eng. Aspects of Nuclear Energy, presented by EARNEST F. GLOYNA, Assoc. Prof. of Sanitary Eng., Univ. of Texas, Austin.

4:00 Industrial Wastes in Atomic Energy

JOSEPH A. LIEBERMAN, Chief, Environmental and Sanitary Eng. Branch, Atomic Energy Commission, Washington, D. C.

FIELD TRIPS

All-Day Friday Trip

This all-day field trip will proceed via the George Washington Memorial Parkway to Chain Bridge on the Potomac, then to the new Central Intelligence Agency near Herndon, Va. Luncheon will be at Herndon. Features inspected will include the new Dulles International Airport, Chantilly, Va.; the interchange between the Circumferential and Axial highways at Annandale, Va.; and the Jones Point Bridge over the Potomac near Alexandria. $4.00 per person, including luncheon. Busses will leave the hotel at 9 a.m. and return at approximately 3 p.m. Friday, Oct. 23.

Trip to Sewage Treatment Plant

A two-hour trip to the world's third largest secondary sewage treatment plant, at Blue Plains, Washington, D. C., will leave the hotel at 9 a.m. Thursday, Oct. 22. $1.50 per person.

Prospective Trips

Two other field trips are in prospect. One is a special two-hour daytime trip to the new Senate Office Building, the new House Office Building, the east front of the Capitol, and the new State Department Building. The second would have as its objective the Package Nuclear Reactor at Ft. Belvoir.

WOMEN'S HOSPITALITY ROOM

Executive Suite **Fourth Floor**

This room will be open each Convention day as a gathering place for all wives attending the Convention. The opening, with tea, will be Sunday, October 18, from 3:00 to 5:00 p.m. Thereafter the hours will be from 9:00 to 5:00, Monday through Friday.

WOMEN'S ACTIVITIES

Monday, Oct. 19

An interesting tour of Washington has been planned, showing many of the attractions of our nation's capital.

Tuesday, Oct. 20

There will be a special tour of the White House to start off this big day in fine style. From the White House, we will proceed to tour historic Alexandria and Mt. Vernon. Luncheon will be served at the Lazy Susan Inn, followed by a trip to Gunston Hall before return to the hotel in the afternoon. $5.50 per person. This trip is limited to 150 women.

Wednesday, Oct. 21

This day has been left free so that those who wish to do so can attend

the ASCE General Business Meeting and the Awards Luncheon with their husbands. Others may wish to visit places of special interest to them or to shop.

Thursday, Oct. 22

Alternate tours are planned for the morning—a tour of the Islamic Center and Washington National Cathedral, or a tour of the Monastery and the Shrine of the Immaculate Conception. After a "Dutch treat" luncheon at the hotel, a visit will be made to the Voice of America studios, where programs are prepared and broadcast throughout the world.

Separate detailed programs giving the time schedules for tours and other events of interest to the ladies will be available at registration.

PURDUE ALUMNI BREAKFAST

On Thursday, Oct. 22, Purdue alumni will meet for breakfast at 8:00 a.m. in the California Room of the Statler-Hilton Hotel.

UNIVERSITY OF ILLINOIS DINNER

The civil engineering alumni of the University of Illinois, with their wives and friends attending the Convention, will meet for the 33rd annual informal dinner on Thursday evening, Oct. 22, 1959, at a place to be announced.

To plan space, please contact Martin E. Jansson, Technical Information Office, Naval Research Laboratory, Washington 20, D. C. (Telephone Johnson 3-6600, Ext. 388.) Dinner will be over in time to permit attendance at the evening events of the Convention.

INFORMATION AND REGISTRATION

Information and registration facilities will be maintained on the Upper Foyer throughout the days of the Convention. Mail and messages will be held for members at the information desk. Announcements seeking individuals will not be made in the sessions of the Convention.

SESSIONS OF THE BOARD

The ASCE Board of Direction will be in session, in the California Room, at the following times:

Monday, Oct. 18, 9:00 a.m. to 5:00 p.m.

Tuesday, Oct. 20, 9:00 a.m. to 3:00 p.m.

Thursday, Oct. 22, 2:30 p.m.

ANNUAL CONVENTION COMMITTEE

Eugene F. Baldi, *General Chairman*
Alfred R. Golzé, *Vice Chairman*
Sylvester E. Ridge, *Vice Chairman*
Vincent B. Smith, *Vice Chairman*
W. Orme Hiltabidle, *Vice Chairman, and President, National Capital Section*
Daniel B. Ventres, *Director, Dist. 5*

Student Committee

Carl H. Walther, *Chairman*
E. J. Scullen, *Vice Chairman*

Committee to Cooperate With Other Sections and Committees

Clifford A. Betts, *Chairman*
Charles J. Stevens, *Vice Chairman*

Reception

Paul C. Brown, *Chairman*
Robert Grunow, *Vice Chairman*

Entertainment

D. L. Chaney, *Chairman*
Frank E. Twiss, *Vice Chairman*

Transportation

Louis Prentiss, *Chairman*
John A. Ruhling, *Vice Chairman*

Excursion

Bernard F. Locraft, *Chairman*
Carl W. Porter, *Vice Chairman*

Finance

T. R. Edmonston, *Chairman*
Theodore Schad, *Vice Chairman*

Public Relations

J. P. Buckley, *Chairman*
J. Coffman, *Vice Chairman*

Exhibits

James H. Carr, *Chairman*
F. J. Hanrahan, *Vice Chairman*

Technical Program

Eugene W. Weber, *Chairman*
L. T. Crook, *Vice Chairman*

Hotel

H. Hemple, *Chairman*
Capt. F. S. Borden, *Vice Chairman*

Registration

Richard S. Goodridge, *Chairman*
Francis J. Flynn, *Vice Chairman*

Attendance and Promotion

Eric E. Bottoms, *Chairman*
George Tomlinson, *Vice Chairman*

Luncheons

Frank L. Weaver, *Chairman*
Daniel Walser, *Vice Chairman*

Women's Committee

Mrs. Eugene F. Baldi, *Chairman*
Mrs. Gail A. Hathaway, *Adviser*

Event Chairmen: Mrs. Daniel B. Ventres, Mrs. John A. Ruhling, Mrs. Bernard F. Locraft, Mrs. David L. Chaney, Mrs. W. Orme Hiltabidle, Mrs. James H. Carr, Mrs. Frank L. Weaver, Mrs. Mason C. Prichard, Mrs. Eugene W. Weber, Mrs. Richard S. Goodridge, Mrs. J. P. Buckley, Mrs. Paul C. Brown, Mrs. Alfred R. Golzé.

THE READERS WRITE

Expanded curricula needed in rapidly changing world

To THE EDITOR: I have read with considerable interest Prof. B. A. Whisler's article on "The Present Crisis in Civil Engineering," in the July issue (vol. p. 489). If, as he states, there is a movement toward withdrawal of professional recognition from civil engineers, there is indeed a crisis in the profession. Although hesitant to take issue with an educator of Professor Whisler's standing, I suggest that our danger may stem less from attempts at infringement on us by others than from our reluctance to broaden the "established curricula."

For some time I have questioned whether a course of study aggregating 36 months or less, over a four-year period, is adequate to entitle a young engineer to a baccalaureate degree. Considerable expansion of curricula is indicated, and should include, but not be limited to, additional instruction in the physical and mathematical sciences. Certainly every engineering student should be given a basic understanding of nuclear physics; also, a basic course in astronomy. I concur that undergraduates do not need to study the calculus beyond differential equations. The graduate can attain proficiency in higher mathematics when and if required.

Civil engineering is perhaps the broadest of all engineering fields and civil engineers after a few years of practice frequently find themselves deeply engaged in administration and management. For this reason, I believe the scope of instruction in non-technical fields should be widened. Full proficiency in the use of one foreign language appears desirable. Civil law, particularly as applied to construction and procurement contracts, is necessary. Instruction in municipal, state and federal government and in labor relations is important. These suggestions are not intended to be all-inclusive.

Such expanded curricula would extend the undergraduate period of instruction to at least five years. This is accepted in some engineering schools today and should be generally adopted. I concur that engineering educators should not permit "inroads on the established curricula," although some subjects might be included in high school. Our salvation may be a very substantial expansion of the curricula to meet the needs of a rapidly changing world.

HENRY E. HELMBOLDT, F.ASCE

Fort Monroe, Va.

A Life Member comments

To THE EDITOR: After forty years of hydraulic engineering practice for the Santa Fe Railway (I retired in 1956), it is rather a shock to find that, according to Mr. Whisler's article in your July issue, I have never really been an "engineer." They should have warned me of this when I graduated from M.I.T. in the Class of 1906.

I not only was not trained in mathematics beyond differential equations, but never even studied that branch of mathematics. My use of calculus was very limited—probably the times I applied it could be counted on my fingers. Nuclear physics had not been invented, but I doubt if it would have improved my skill. I did, as the years went by, add a little to my good judgment and common sense in solving engineering problems, but it was a slow process, and I doubt if it could have been learned in any engineering college.

GEORGE L. DAVENPORT, JR.
Life Member, ASCE

Los Angeles, Calif.

A "Younger Viewpoint"

To THE EDITOR: The article by Professor Whisler, "The Present Crisis in Civil Engineering" (July issue, vol. p. 489) was certainly badly needed. It would be desirable if this article could be the beginning of a trend back to sound civil engineering education for the practical civil engineer.

As a 1958 graduate of Michigan State University, I was caught in the nuclear physics portion of this unfortunate web. (It is my understanding that differential equations have since attained a similar status.) As more of these unnecessary courses are added to the undergraduate curricula, we hear the cry for a five-year program or else feel the pressure for a master's degree.

Now it is agreed that additional education is a desirable goal, but there must be sensible limits established for undergraduate studies. Nuclear physics, complicated mathematics, and the inner mysteries of electronic devices should more properly be reserved for graduate work.

On the other hand there are areas that are receiving too little attention in the undergraduate curricula. One such field is prestressed concrete. This is a "basic," but it is suffering from an obvious lack of understanding. Another neglected (or perhaps de-emphasized) field is the testing and experimental laboratory. Testing and experimental apparatus is available in university laboratories, and the student should be given every opportunity to become familiar with its application and use. Unless a graduate is very fortunate, this will be his primary contact with a major branch of the civil engineering profession.

These are only two of the areas that are at present receiving inadequate attention in some circles. There are undoubtedly others. Is this due to an unrealistic attitude and to undue emphasis on extremely technical and narrow branches of engineering?

Perhaps to some of the "egghead" engineers, the down-to-earth approach is repulsive. However, many of us are thankful for our experience in the laboratories and in other traditional phases of the curricula. It would be worth while if the educational emphasis could be restored to its proper perspective.

LEE S. EDWARDS, A.M. ASCE
Assistant Engineer
Bay County Road Commission

Bay City, Mich.

Engineering as an art

To THE EDITOR: "The Present Crisis in Civil Engineering," by Professor Whisler, in the July issue (vol. p. 489), reminds me of the time—not too long ago—when the soil mechanics boys were about to run the foundation engineer out of the picture, and of the many educators, including myself, who sailed off after the fluid mechanics fad.

The foundation engineers are still at the old stand, aided immeasurably by the science of soil mechanics; and hydraulics as well as fluid mechanics is taught to civil engineering students.

This is not to say that Professor Whisler's fears are unfounded. They are based on very real trends. Here again, however, I believe we are watching the pendulum swing. The how-to-do engineering courses, dictated by the get-rich era of the '20's, are being eliminated, and the pendulum will swing too far to the left before we stop it. But it will slowly but certainly swing back to the concept of engineering as an art based on the sciences, and made functional by experience, intuition, judgment and qualitative design.

I hope the theorists will not do too much harm before they are halted.

DEWEY M. MCCAIN, F.ASCE
Head, Dept. of Civil Eng.
Mississippi State Univ.

State College, Miss.

Improved culvert design

To THE EDITOR: In the July isssue (vol. p. 492), Fred W. Blaisdell, F.ASCE, commented on my article in the March issue (vol. p. 167), entitled "Improved Culvert Performance Through Design and Research Studies." I wish to thank him for his comments and to clear up an apparent misconception.

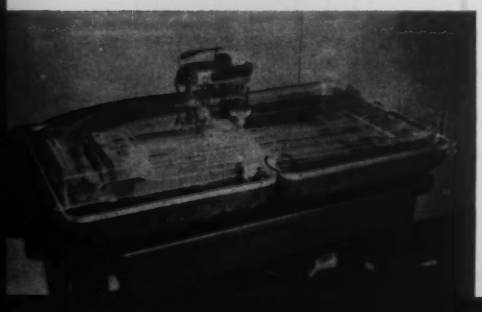
The article does not state that "the culvert inlet must be submerged at least 1.5 velocity heads," as Mr. Blaisdell infers. The value merely happened to be 1.5 for the example analyzed, assuming the water level at the outlet to be at the level of the culvert, and the culvert slope to be equal to the friction slope. The research performed by Mr. Blaisdell has demonstrated that lesser values can be used with full culvert flow provided the entrance is properly designed. The best performance of such designs usually involves suppression of the vortex, which otherwise would aerate the flow and prevent the full use of the barrel by the flowing water. Mr. Blaisdell and other researchers both past and present are to be praised for their contributions to culvert design.

One governing principle of culvert flow is the law of energy conservation. The culvert that involves the least energy loss for a given discharge has the maximum capacity at a given head differential. All attempts to improve culvert performance are based on this principle.

In conclusion, I wish to endorse Mr. Blaisdell's remarks about "demonstrations ... to get points across in a minimum of time." The photograph (left) shows a portable hydraulic laboratory which I have used in many state highway departments to demonstrate the different types of flow possible in culverts and the advantages of proper inlet and outlet designs.

WILLIAM J. BAUER, M. ASCE
Consulting Engineer

Chicago, Ill.



"Practical" curricula urged

To THE EDITOR: I noted with considerable interest the article by B. A. Whisler, "The Present Crisis in Civil Engineering," in the July issue. I would like to urge the American Society of Civil Engineers to do what it can to help retain the present practical curricula for civil engineering in the various colleges and universities.

We have had considerable difficulty in obtaining civil engineers in our business of supplying water and gas to the City of Omaha and vicinity. For the past few years we have been unable to get civils but are making use of other types of engineers. In general, these engineers are not required to take the courses that are as valuable to us as those offered to the civil engineering students. I agree that the study of nuclear physics and similar courses should be left for the graduate engineer who desires to follow a scientific rather than an engineering career.

KENNETH YOUNG, M.ASCE
General Supt., Eng. and Construction Dept.,
Metropolitan Utilities Dist.

Omaha, Nebr.

SOCIETY NEWS

Memo to 33,830 ASCE Members

A mistake, you will say at once, the Society has over 43,000 members! And so it has, but this piece is addressed especially to those of our 43,447 members who have not yet contributed to the campaign for funds for the United Engineering Center. To date (August 14) slightly over 20 percent of our members —a mere 9,617 of them—have contributed a whopping $557,338, or 70 percent of ASCE's assigned quota of $800,000. Almost $250,000 is still needed if the Society is to meet its quota. With even a very modest contribution from you 33,830 members, the Society will be able to write off this obligation, and the editors will be able to stop writing these appeals that you must be tired of reading!

On the credit side of the campaign picture, ASCE is now third on the list of the five Founder Societies in the member-giving campaign. In first place, as reported in August, is the American Institute of Chemical Engineers, which has met its quota—the first society to reach its goal. Instead of resting on its laurels, the AIChE is seeking additional funds, partly to give members that have not yet contributed a chance to do so.

A four-page brochure, "Two Key Men in Engineering," is being mailed to Local Section officers and fund-raising personnel. ASCE participated in the production of this brochure, which was designed as a home-stretch appeal in the drive for funds. In its cogent résumé of reasons why engineers should realize their obligation and their privilege to contribute toward the building of the Center, the brochure states:

"You, through your professional membership, will own the United Engineering Center.

"You, as an engineer, will share in the benefits the Center will bring.

"You, as a proud member of a proud profession, hold the key to your profession's prestige, recognition, and advancement."

The Industrial Building Fund Committee, which has already done so much to assure the success of the UEC campaign by raising $4,500,000 of a $5,000,000 quota, has addressed its own promotional piece to the relatively few industries that have not yet participated in the drive for funds. For those who have not felt the "obligation to contribute," the Committee summarizes the important role in modern society of the five major professional societies that will share the Center together with other important professional groups. The summary says in part:

"The five Founder Societies that will occupy the new Center represent at least 80 percent of the total area of the nation's technology and engineering. Each of these five professional Societies makes large contributions to the nation's technology and engineering strength. Their extensive publications and the papers presented in their local, district, and national meetings are of the greatest value of the engineers and to the industries employing them.

"They render invaluable service to engineering education through these publications and the student branches that they initiate and aid. Their joint participation in the Engineers Council for Professional Development provides a much needed insurance of the quality of engineering education. The curricula of each engineering school, which ECPD certifies, must contain at least a prescribed amount of science, mathematics, and engineering subject matter whose quality is assessed by periodic inspections by ECPD.

"These Societies maintain and insure high professional standards among the nation's engineers. While they do not and should not make any frontal attack on the unionization of engineers, their very existence and the things they stand for provide the best insurance against such unionization. Universal unionization of our engineers would have tragic results for the nation.

"These Societies cooperate with and participate in the activities of standardization and specification of dimensions and materials of vital importance to all industry. Standardization organizations will be tenants of the new Center.

"The professional relationships of American engineering with that of the rest of the world are the responsibility of each of these five Societies in their respective areas of technology."

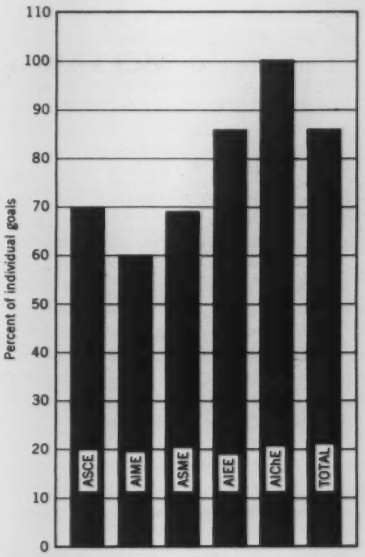


FIG. 1. Member giving for United Engineering Center as of August 14.

UEC HONOR ROLL

There are still twenty Local Sections on the UEC Honor Roll—no change from the number reported in the August issue, alas! Congratulations once again to these ambitious few—barely over 25 percent of the Society's Sections. The Sections are listed here in the order in which they met their quotas, and the figures indicate percentages attained on July 31.

Kentucky (109)
Lehigh Valley (132)
Nashville (103)
Cincinnati (141)
Columbia (127)
Philadelphia (126)
Hawaii (119)
Rochester (123)
Ithaca (114)
Southern Idaho (144)
Indiana (132)
Delaware (105)
Kansas City (109)
Central Pennsylvania (106)
Arizona (108)
West Virginia (120)

Central Ohio (102)
Tri-City (105)
Puerto Rico (106)
Wisconsin (101)

Congratulations are due again, also, to **District 4,** the only District that has exceeded its quota and the only District whose Sections have all exceeded theirs.

Campaign in ASCE Sections

Local Section	Quota %	Local Section	Quota %
Over the Top			
South. Idaho	144	Kansas City	109
Cincinnati	141	Kentucky	109
Lehigh Valley	132	Arizona	108
Indiana	132	Central Pa.	106
Columbia	127	Puerto Rico	106
Philadelphia	126	Delaware	105
Rochester	123	Tri-City	105
West Virginia	120	Nashville	103
Hawaii	119	Central Ohio	102
Ithaca	114	Wisconsin	101
Going Strong			
Rhode Island	97	Illinois	81
Iowa	88	Tenn. Valley	80
Connecticut	87	Central Illinois	77
Georgia	85	Nebraska	77
Tacoma	84	Maine	76
Metropolitan	82	San Francisco	76
Past the Mid Point			
Texas	74	Kansas	59
Syracuse	73	Sacramento	55
Spokane	66	Akron	54
Duluth	65	Mid-Missouri	53
Maryland	65	Mid-South	53
Pittsburgh	65	Mohawk-Hudson	50
Massachusetts	64	North Carolina	50
Buffalo	62	Toledo	50
Dayton	62		
Seattle	60		
Getting on Target			
Cleveland	48	New Mexico	37
San Diego	48	Venezuelan	37
South Carolina	48	Nat'l Capital	35
Intermountain	47	Northwestern	35
St. Louis	47	Panama	34
Montana	46	Colorado	32
Los Angeles	43	New Hampshire	32
Virginia	40	Mexico	28
Oklahoma	39	Wyoming	28
Oregon	39	South Dakota	26
Alaska	38	Alabama	25
		Michigan	25
Slow Starting			
Louisiana	22	Brazil	11
Miami	18	Rep. Colombia	10
Florida	15		

ASCE Membership as of August 10, 1959

Fellows	10,781
Members	15,544
Associate Members	16,984
Affiliates	91
Honorary Members	47
Total	43,447
(August 9, 1958	41,612)

ASCE Executive Committee Actions Briefed

The executive committee of ASCE met at Ann Arbor, Mich., on August 7 to take action on items delegated to it by the Board of Direction or requiring action before the Board meeting in late October. President Friel presided; present were Past-Presidents Lockwood and Howson and Vice-Presidents Morris, Bowman, and Knapp. Vice-President Holland is recovering from a serious illness and was not present.

Engineering Functions in Government

President Friel was authorized to participate in meetings with the presidents of Engineers Joint Council, the American Institute of Consulting Engineers, the Consulting Engineers Council, the National Society of Professional Engineers, and the American Road Builders Association to discuss the present concern of Congress with the merits and economics of engineering services to Federal Bureaus by their own engineering departments or by the engagement of engineering firms in private practice. It was noted that ASCE is especially interested, as its members include employees of government agencies as well as principals and employees of private firms.

Concerning per diem fees for government agencies, the Executive Secretary was requested to direct the attention of appropriate federal officials to the recommendations contained in ASCE Manual of Practice No. 38. It is hoped that this will be helpful in upgrading fees, now fixed at $50 per day in many agencies.

Engineering Unity

The statement, "The ASCE Philosophy of Engineering Unity," which appears on page 33 of this issue, was approved and early publication in Civil Engineering was requested.

Brochures

A 100,000-copy edition of a brochure, "Your Future in Civil Engineering," was authorized. It will be published in 6- by 9-in. size, which is used for most Society bulletins, at a cost of $6,500. An additional cost of $3,200 for a larger format and other changes was not considered justified.

Publication of a revised Student Chapter handbook, as developed by the Committee on Student Chapters, was authorized for immediate distribution to Student Chapters.

Sponsorship of Curricula Studies and Research

Authority was granted to the Committee on Engineering Education to commit the Society to joint sponsorship of the civil engineering curricula studies, which are being financed by the National Science Foundation, whenever such programs are found in the unanimous opinion of the committee to be appropriate and in the best interests of the Society.

The Executive Committee voted to recommend to the Board of Direction that the Society offer to assume the sponsorship and to act in a fiscal and administrative capacity for the civil engineering Research Councils now represented in the Engineering Foundation, with the Society to assume the administrative costs involved. The two groups specifically requesting ASCE sponsorship are the Reinforced Concrete Council and the Research Council for Riveted and Bolted Structural Joints.

Travel

The Executive Committee recommended that the Board of Direction authorize, on a trial basis for 1959-1960, travel reimbursement for a chairman of a principal technical committee to attend a meeting of a Technical Division executive committee or for a Division executive committee member to attend a meeting of a principal technical committee, provided that no Division shall expend in excess of $300 under this authorization. A suggested change in the rules of policy and procedure to authorize reimbursement of travel costs for the chairman of each task committee, under an "administrative" committee, to attend meetings of administrative committees (technical) could cost an additional $13,000 per year. Action was referred.

Life Insurance

It was recommended to the Board of Direction that a group life insurance plan, proposed by the administrators of the ASCE Group Insurance Program, be adopted under a trusteeship and that the plan be publicized as a new and valuable service to Society members.

Other Actions

A request to present non-Society awards at a Convention function of ASCE was rejected . . . The Society endorsed the appointment of Leslie N. McClellan, F.ASCE, to the International Joint Commission, in view of his distinguished career in hydrology and hydraulic engineering . . . The invitation of the Nashville Section for the Executive Committee to hold its December 1959 meeting in Nashville in connection with a special meeting of that section was accepted with thanks.

NSPE Reports Results of Salary Survey

Median income for professional engineers rose to a record high of $10,000 in 1958. The figure is based on an analysis of 19,240 questionnaires returned by members of the National Society of Professional Engineers for the fourth biennial "Professional Engineers' Income and Salary Survey" published by the NSPE. Though earnings were high at all levels, gains generally were smaller than those recorded in the first three surveys. The median income is up 5 percent in the 1958 Survey, compared with a 9 percent increase recorded in 1954 and a 12 percent hike in the 1956 Survey.

The drop was especially marked at the highest levels. Upper quartile earnings show only a 3 percent increase in the 1958 survey in contrast to 10 percent in 1956. Upper decile incomes actually were down 1 percent compared with a 9 percent increase reported in the last survey.

Despite these drops, earnings were high at all levels in 1958 with only 10 percent of the questionnaires listing incomes below $7,040. At least 75 percent of those participating in the Survey reported incomes of $8,250. The upper 10 percent listed incomes of at least $19,680.

Chemical engineers again reported the highest earnings with a median income of $11,170, an increase of $170 over the 1956 figures. Civil engineers remained on the bottom of the salary rung, despite a jump in median income from $8,750 to $9,260.

One of the features of the 1958 report is a detailed analysis of salary trends recorded in the four surveys conducted since 1952. Here are some of the major trends reported in the new survey:

All segments of the profession enjoyed further income gains between 1956 and 1958, but engineers connected with the business sector experienced smaller relative gains than those in other types of employment.

While the younger engineers continued to register salary increases, their gains were in line with those of the more experienced engineers, and not considerably higher, as was the case in the past.

There appears to be a continuing trend —already apparent in 1956—toward a gradual lessening of certain types of income differentials. In particular, regional salary differentials seem to be decreasing, and there also seems to be a tendency for the various fields of employment to pay similar salaries for comparable work. In particular the gap between earnings in industry, educational institutions, and the Federal Government was narrower in 1958 than it had ever been before.

Correlation of Salary Surveys

ASCE's biennial survey of civil engineering salaries was reported in digest form in the August 1959 issue of CIVIL ENGINEERING. Correlation of the data in this survey with the results of other engineering salary surveys has not been attempted. Aside from indications of major trends, few areas exist for direct comparison of results.

The NSPE survey reviewed here shows a 5 percent overall increase in engineering income for 1956-1958. The ASCE survey shows an increase of 5.7 percent in salaries paid to civil engineers (1957-1959). An increase of 6.2 percent is reported for the professional grades, and 2.6 percent for the subprofessional grades.

Westinghouse Official Wins John Fritz Medal

For the first time in the 58-year history of the John Fritz Medal, the 1960 award will go to a man with a non-engineering background for his vision and industrial leadership in the development of atomic power. The John Fritz Medal Board of Award has announced that the award, sometimes called the top honor in the profession, will be made to Gwilym A. Price, chairman of the board of the Westinghouse Electric Corporation. Presention of the gold medal to Mr. Price will be made at the annual meeting of the American Society of Mechanical Engineers in Atlantic City early in December.

A lawyer, banker and industrialist, Mr. Price has been with Westinghouse since 1943 and chairman of the board since 1955. A pioneer in recognizing the peacetime possibilities of the atom, he formed an atomic power organization within his company that has designed the nuclear propulsion plants for virtually all the Navy's growing atomic fleet. The citation accompanying his award hails "his industrial leadership, industrial pioneering and personal initiative in marshalling the creative forces of research and engineering to the cause of developing atomic power for the national defense and for the human welfare."

The John Fritz Medal was established by the Founder Societies in honor of John Fritz, Hon. M.ASCE, an American pioneer in the iron and steel industry, who received the first award in 1902. The medal is awarded annually for notable scientific or industrial achievement.

Group Insurance Program

The Continental Casualty Company, administrators of the ASCE Group Insurance Program, reports paying the first death claim under the liberalized underwriting rules, which extend plane-crash coverage to other than commercial aircraft. The death claim of $7,500 was paid to the estate of a member killed this March in the crash of a company plane.

Payment of this claim stresses the value to members of the liberalized provisions of the Group Insurance Program, which were approved by the Board of Direction a year ago. Extension of the aviation exclusion clause to cover all flying situations except "operating, learning to operate, or serving as a member of a crew of any aircraft" was one of several major benefits made available to members under the liberalized plan.

The Group Insurance Program is beginning its eleventh year of operation.

SOCIETY AWARDS AND FELLOWSHIPS AVAILABLE

DANIEL W. MEAD PRIZES: *1960 contest closes May 1, 1960. See 1959 Official Register page 143, and July 1959 issue of CIVIL ENGINEERING, page 66.*

FREEMAN FELLOWSHIP: *1960-61 (closing date pending). See Official Register, page 154.*

ERNEST E. HOWARD AWARD: *Closing date Feb. 1, 1960. See Official Register, page 142.*

ASCE RESEARCH FELLOWSHIP: *1960 contest closes March 15, 1960. See Official Register, page 156.*

J. WALDO SMITH HYDRAULIC FELLOWSHIP: *1961-62 (closing date pending). See Official Register, page 156.*

Division Doings

Appointees to Technical Division Executive Committees

J. PAUL BUCKLEY
Chief Engineer, Highways Div.
Automotive Safety Foundation
Highway Division

NATHAN CHERNIAK
Economist-Comprehensive Planning
Port of New York Authority
City Planning Division

ROBERT T. COLBURN
Vice President, Charles T. Main, Inc.
Power Division

E. P. FORTSON, JR.
Chief, Hydraulics Division
Waterways Experiment Station
Hydraulics Division

CARL B. JANSEN
President, Dravo Corporation
Construction Division

HERBERT E. PRATER
Regional Engineer, Region 7
Bureau of Reclamation
Irrigation & Drainage Division

H. LOREN THOMPSON
Partner, Stevens & Thompson
Sanitary Engineering Division

EVAN W. VAUGHAN
Associate in Parsons, Brinckerhoff, Hall and Macdonald
Waterways and Harbors Division

MERIT P. WHITE
Head, Civil Engineering Dept.
University of Massachusetts
Engineering Mechanics Division

D. R. WILLIAMS, JR.
Executive Vice President, Williams Brothers Company
Pipeline Division

Structural Conference on Electronic Computation

There have been numerous new developments in the field of structural applications of computers since the first Conference on Electronic Computation took place in Kansas City, Mo., in November 1958. Planning for a Second Conference —to be held at the Pittsburgh Hilton Hotel in Pittsburgh, September 8 and 9, 1960—is now underway. Conference sponsors will be the Structural Division's Committee on Electronic Computation and the Pittsburgh Section of the Society.

Four main themes are planned:

1. **Design Applications**—Outstanding applications in the field of design will include such areas as optimization of structures and least-cost design.
2. **Structural Analysis**—Emphasis will be on methods developed or adapted specifically for use on computers.
3. **Mathematical Methods**—New developments and techniques in numerical analysis methods for structures.
4. **Professional Problems**—Education and utilization of engineers in the computer age.

Interested engineers are cordially invited to submit papers. Prospective authors must submit an outline of their papers by November 30, 1959, and the complete manuscript will be due by April 15, 1960. Final selections will be announced by June 15, 1960. Abstracts and manuscripts should be sent to the Chairman of the Program Committee: Jackson L. Durkee, Bethlehem Steel Company, Fabricated Steel Construction, Bethlehem, Pa. Prospective authors are urged to notify Mr. Durkee at once of their intention to submit a paper. He would like to know the title of the paper and the approximate date when he can expect to receive the abstract.

General inquiries about the Conference should be addressed to the Vice-Chairman of the Program Committee: Jerry C. L. Chang, Richardson, Gordon & Associates, 3 Gateway Center, Pittsburgh 22, Pa.

Hydraulics Division Seeks Data on Energy Dissipators

A Task Force of the Hydraulics Division is currently engaged in the preparation of a report on prototype experiences with energy dissipators for spillways and outlet works all over the world. Questionnaires have been prepared and distributed to known sources of information.

Anyone who has information about such prototype experiences but who has not received a questionnaire is asked to get in touch with R. H. Berryhill, Chairman of the Task Force on Energy Dissipators for Spillways and Outlet Works. Mr. Berryhill's address is P. O. Box 1600, Fort Worth, Tex.

Errata—Manual on Treatment Plant Design

Two corrections in Manual of Engineering Practice No. 36, "Sewage Treatment Plant Design," prepared jointly by ASCE and the Federation of Sewage and Industrial Wastes Associations, have been brought to the attention of readers (July 1959 issue, page 71). Those now using the manual are urged to notify either organization if other errors are found, so that an errata sheet can be prepared. The errata sheet would be included in all manuals sold after its issuance and would also be made available to all who had already purchased the manual.

If corrections are to be included in the errata sheet, they must be received in the headquarters office of either organization prior to November 1.

ASCE Manual Studies Sanitary Landfills

The depositing of waste products on land is probably the oldest known method of waste disposal. The scientific development of this method in the United States, however, has taken place only in recent years. A review of the sanitary landfill method of refuse disposal was undertaken, in 1954, by a committee of the Sanitary Engineering Division of ASCE. The results of that committee's work are discussed in ASCE Manual of Engineering Practice No. 39, entitled "Sanitary Landfill."

The purpose of this new ASCE manual is to bring together the desirable and accepted practices involved in the operation of a satisfactory landfill. The manual includes a definition of this method of refuse disposal, which was used as the criterion in selecting and preparing the material to be covered. It should serve as a guide to those who desire to conduct an acceptable operation.

Copies of Manual No. 39 can be ordered from ASCE by use of the coupon in the advertising section of this issue. The list price is $2.00, and Society members are entitled to a 50 percent discount.

Soils Stabilized by Heat Soviets Tell Seminars

Soviet work on thermal stabilization of loess soils in the Ukraine was one of several interesting developments described by Soviet soils engineers at a series of seminars held at U.S. universities. The Soviet group has returned to Russia. Seven American soils engineers go to Russia in September in an exchange.

The chairman of the delegation, Academician I. M. Litvinov, commented on macroporous loess soils that easily collapse when they are rainsoaked under load. By injecting compressed air together with fluid or gas fuel directly into bore holes through special burners and perforated casings, the loess was transformed to a depth of 30 ft around each hole into a 10-ft-dia cylinder of hard brick-like substance. The method is economical for large structures and shallow foundations. It was successfully used under new multi-story buildings and 300-ft-high factory chimneys. It was even used for underpinning since no shrinkage of the baked loess occurs in situ, presumably due to pressures which the combustion gases and evaporating water develop in the pores of the loess.

Prof. N. A. Tsytovich outlined the Soviet theory and practice of foundation construction on frozen ground, a field in which much pioneering work has been done in the USSR. Entire cities and heavy structures are now safely erected on frozen ground. Professor Tsytovich commented that Soviet methods of foundation design are based on limit states of soil equilibrium and on limit settlement values permitted for different types of structures.

There was considerable interest everywhere in the report presented by I. M. Levkin on the Soviet use of heavy vibrators for the sinking of piles and large (up to 16-ft-dia) open-end cylindrical precast reinforced concrete caissons. R. A. Tokar outlined the Soviet approach to machine foundation design. Prof. V. M. Bezruk reported on flexible pavement design from theory and experience under widely varying climatic and traffic conditions.

In addition to the laboratories of MIT, Princeton, Illinois and California universities, where the seminars were held, the Soviet delegation visited the soil engineering laboratories of Rutgers and Harvard universities, of the California Division of Highways at Sacramento, and of the Bureau of Public Roads in Washington, D. C. The AASHO test road at Ottawa, Ill., and foundation construction sites in New York, Boston, and Chicago were also visited.

The Soviet engineers presented their American local hosts with copies of many Russian language publications which amplified the topics dealt with in their seminar reports.

The Highway Research Board is preparing for publication translations of the Soviet reports with relevant illustrations shown at the five U.S. seminars. The Board was the prime sponsor of this exchange of delegations. Fred Burggraf, F. ASCE, director of the Highway Research Board, initiated and directed the exchange, which was co-sponsored by ASCE.

The U.S. exchange delegation to Russia this fall will be headed by Miles S. Kersten, M. ASCE, professor of civil engineering at the University of Minnesota. The other members are Gregory P. Tschebotarioff, F. ASCE, professor of civil engineering at Princeton University; Dr. T. William Lambe, F. ASCE, head of soil engineering at Massachusetts Institute of Technology; Prof. G. A. Leonards, M. ASCE, of the Purdue University School of Civil Engineering; John Lowe, III, M. ASCE, chief soils and foundation engineer, Tippetts-Abbett-McCarthy-Stratton, New York, N. Y.; Prof. H. Bolton Seed, M. ASCE, of the University of California School of Civil Engineering; and Willard J. Turnbull, F. ASCE, chief of the Soils Division of the Waterways Experiment Station, Vicksburg, Miss.

ASCE ENGINEERING SALARY INDEX

(Prepared Semiannually)

Consulting Firms

City	Current	Previous
Atlanta	1.13	1.22
Baltimore	1.12	1.11
Boston	1.18	1.15
Chicago	1.36	1.30
Denver	1.21	1.20
Houston	1.26	1.12
Kansas City	1.11	1.14
Los Angeles	1.21	1.21
Miami	1.57	1.57
New Orleans	1.03	1.21
New York	1.25	1.21
Pittsburgh	0.95	1.05
Portland (Ore.)	1.16	1.11
San Francisco	1.24	1.19
Seattle	1.06	1.06

Highway Departments

Region	Current	Previous
I, New England	0.92	0.89
II, Mid. Atlantic	1.13	1.17
III, Mid West	1.16	1.25
IV, South	1.08	1.10
V, West	1.02	1.02
VI, Far West	1.11	1.15

Sole purpose of this Index is to show salary trends. It is not a recommended salary scale. Nor is it intended as a precise measure of salary changes. The Index is computed by dividing the current salary total for ASCE Grades I, II and III by an arbitrary base. The base is $15,930. This is the total of salaries paid in 1956 for the equivalent Federal Grades GS5, GS7 and GS9. Only the annual base entrance salaries are used in these calculations. Index figures are adjusted semiannually and published monthly in Civil Engineering. Latest survey was January 31, 1959.

The Younger Viewpoint

Committee on Younger Member Publications

Milton Alpern, Chairman; 3536 Northview Ave., Wantagh, L. I., N. Y.

Zone I	Zone II	Zone III	Zone IV
Donald Kowtko 510 Millburn Ave. Millburn, N. J.	Albert C. Nelson 250 N.E. 51st Street Miami, Fla.	Walter D. Linzing 4751 No. Paulina Chicago 40, Ill.	Rodney P. Lundin 9744 Quakertown Ave. Chatsworth, Calif.

Zone II is at the helm in this issue. Albert Nelson, reporting for the Zone, has enlisted the services of two younger members to help him scout for news—Herbert L. Allen, Jr., of the Tennessee Valley Section, and Kenneth D. Mayhew, Jr., of the Delaware Section. If you happen to belong to one of these Sections, you can express your ideas for "The Younger Viewpoint" to either of these men and they will report them.

Engineering Education

Walter Linzing, reporter for Zone III, has forwarded a letter from James S. Hoffman, A.M. ASCE, of Ames, Iowa, giving his views on engineering education. Excerpts from his letter follow:

"I believe that the engineering curriculum should be extended to five years. . . . Some courses that might be added in the technical field are on prestressed concrete, electronic computers, and technical writing. A little more English and speech courses would also help. There should also be room for a few electives, both technical and non-technical. The technical electives would allow for some additional work in the student's choice field, while the non-technical electives would help to broaden his education.

"Let's get some more views on education from other young members. Most members should have some ideas on how to improve the engineering curriculum that they took.

"Concerning technical papers and younger members, I feel that many of the technical papers do not catch the interest of the younger members. Occasionally, a paper interests a younger member, and he should then take the required time to write a discussion, if he has anything to add to the paper.

"I think 'The Younger Viewpoint' is a good column. Please continue it."

In a recent letter Tom Hubbard, A.M. ASCE, of the Maine Section, states, "One of the things that I honestly would like to hear aired is the older, more established civil engineer's opinion on non-registered engineers' soliciting work from architects and clients on a part-time basis (in addition to their regular job). This practice could infringe somewhat on the professional engineer's business."

A point obviously well taken, since the topic for the Daniel Mead Award this coming year is "Under What Conditions May An Employee Do Engineering Work Outside His Normal Employment?" Truly a perplexing ethical problem. By the way, it's worth $100 if your analysis of the topic (in writing) is the best. How about that for easy money?

Sweet Smell of Success

While many of the 78 Local Sections that comprise ASCE find themselves brow-beating and coaxing their members into contributing to the United Engineering Center, 20 Sections have contributed 100 percent or more of their quota.

A perusal of the statistics shows percentages of contributions ranging from about 10 percent to well over 100 percent. It can be agreed that the standard of living of the civil engineer is relatively uniform throughout the land. And it can further be agreed that the chairmen of the drives are equally hardworking and conscientious. What then gives impetus to donations in one place and not in another? Curiosity overtook "The Younger Viewpoint," and we asked those Local Sections in Zone II who surpassed the 100 percent mark to send us their success story. The story from the Central Pennsylvania Section is especially appealing, as reported by R. G. King, AM. ASCE:

"The fact that the drive in the Central Pennsylvania Section was so well organized by Samuel Zack, the chairman of the committee, is in my estimation, the chief reason for the success of the effort. The organization of the committee included two Section co-chairmen, and one from each of the larger communities in the Section. Each co-chairman, in turn, chose committeemen who represented each of the large employed groups of engineers in his area. In this manner every Section member within these three larger, more concentrated areas was personally contacted. In addition, the committee included representatives from outlying areas. By means of only two general committee meetings, plus the constant supervision of Mr. Zack, the well organized program was carried out with very little lost motion, and the goal of $5,700 was attained with surprising ease.

"Another factor that seemingly implemented our program was that our Section is comparatively new and free from the inertia that is likely to handicap older groups. It has the zest of a new enterprise.

"One other circumstance, I feel certain, must have helped this campaign, not only in our Section, but also on a nation-wide scale, is the interest among engineers today in the responsibilities and stature of the engineering profession in the world's ever-changing society. . . . Since it is only by common effort that the engineering profession will continue to grow in stature, it is self-evident that a United Engineering Center at this time is a necessity. Surely an appeal on this basis alone should give impetus to the drive for funds."

In Closing

In the July issue of the *American Engineer* Paul Robbins, NSPE executive director, writes, in an article entitled "The Engineer and Culture," "Readers will recall the disturbing results of a survey by Purdue University several years ago which showed an alarmingly high percentage of high school students feeling that scientists and engineers could not be trusted, were unusual people, and did not lead normal lives. The survey more recently by the University of Washington, quoted last month in this column, indicated a general feeling by the public of little contribution to the welfare of the people coming from engineers."

A challenging article in the July 13, 1959, issue of *Chemical Engineering*, could profitably be read by all engineers concerned with the meaning of engineering licensure. "Why Engineering License Laws?" by A. W. Gray, attorney, presents good arguments against those of us who see so much value in strong engineering license laws. Read it and defend your position.

Your personal appraisal for this month should ask:

As a neighbor and citizen, what place in my community and in government should I take?

How should I prepare myself to carry out my community and political responsibilities?

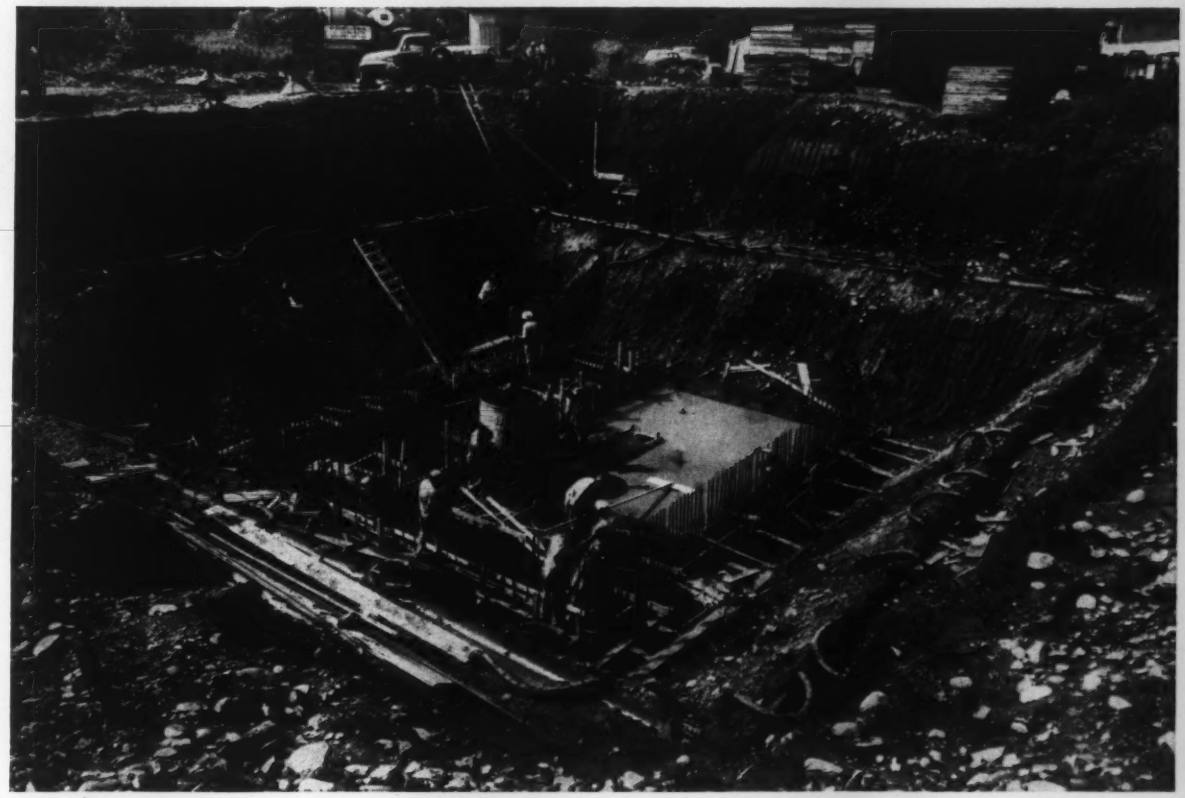
Am I developing my capacity for friendship and utilizing opportunities for broadening the circle of which I am a part?

Do I contribute my share toward making these social contacts valuable to others as well as to me?

HOW TO HANDLE WET JOBS

#50 of a series

Project: Pumping Station, New Brighton, Penna.
Consulting Engineer: Michael Baker, Rochester, Penna.
Contractor: Engstrom & Wynn Company, Wheeling, W. Va.



Soil bouldery, sheeting impractical; wellpoint system solves tough ground-water problem as . . .

New-type Holepuncher Installs Wellpoints

Patent applied for

Since the work site consisted of coarse sand and gravel with many boulders, Engstrom & Wynn were faced with a very difficult and expensive job if they chose to drive a steel sheet pile cofferdam to handle their ground-water problem.

• **They were satisfied,** as was the consulting engineer, that a system of Griffin's extra-capacity "Aquahog" wellpoints would control the ground-water volume, but there remained the question: could the wellpoints be installed through the obstructing boulders?

• **The photo shows** the answer: successful installation achieved with a new "sliding-weight" holepuncher* developed by Griffin engineers. 16 ft of ground water was lowered without difficulty.

• **Using open cut** and wellpoints installed with the new holepuncher, the contractor's cost proved to be just a fraction of what it would have been with sheeting. This same economical Griffin method has recently been used at Titusville, Oil City and Warren, Penna.

*Patent applied for

GRIFFIN WELLPOINT CORP.

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GENERAL OFFICE: 881 East 141st St., New York 54, N. Y.

BRANCHES: HAMMOND, IND. • HOUSTON, TEX. • NEW YORK, N. Y. • JACKSONVILLE, FLA. • WEST PALM BEACH, FLA.

In Canada: Construction Equipment Co., Ltd., Toronto • Montreal • Edmonton • Vancouver
In Venezuela: Drew Bear & Sons C.A., Caracas • Maracaibo

25th YEAR

NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the fifth of the month preceding date of publication)

Edward Joseph Morgan, president of the **Hawaii Section,** was a recent sightseer in New York City. President Morgan is manager and chief engineer of the Honolulu Board of Water Supply . . . The Wives' Auxiliary of the Section recently sponsored a senior reception honoring civil engineering students at the University of Hawaii. During the evening five outstanding seniors received Junior Memberships in ASCE. They were Calvin Kim, Albert Koga, Reginald Young, Conway Yamamoto and David Higa, all of Honolulu. The active Wives' Auxiliary is headed by Mrs. William Tinniswood, and Mrs. Richard Libbey is secretary.

E. J. Morgan

The 1959 anniversary meeting of the **Maine Section** was held on August 1 at Homewood Inn on Casco Bay at Yarmouth. The afternoon of relaxation and fun for members, family and friends—a turnout of 67—was highlighted by a trip around the bay in a chartered cabin cruiser. In the evening President Francis S. Friel talked interestingly on what the Society means and does for its members.

The **Nashville Section** has been actively campaigning against local government agencies' accepting from construction contractors unengineered plans for small structures, based on altered state standard designs. Directly as a result of this Section activity Angus Jessup, M. ASCE, was engaged to design a bridge in Maury County. Bids were taken on three alternates: (1) poured-in-place concrete deck, (2) prestressed box girders with poured deck, and (3) four lines of steel girders with a poured deck. Low bid was on the steel girder alternate. The Nashville Section is publicizing the money (and in this case 50 days shorter construction time) saving to the county over what might have been the case if a directly selected contractor had been permitted to use one of the other designs without competition for construction. E. M. Dougherty, president of the Nashville Section, supplied this information. [Secretary Wisely commends this type of action to Local Sections as a worthwhile endeavor in the public interest.]

Current trends in engineering enrollment in colleges and universities were discussed at a recent **Sacramento Section** meeting by H. B. Blodgett, dean of engineering at the University of Nevada.

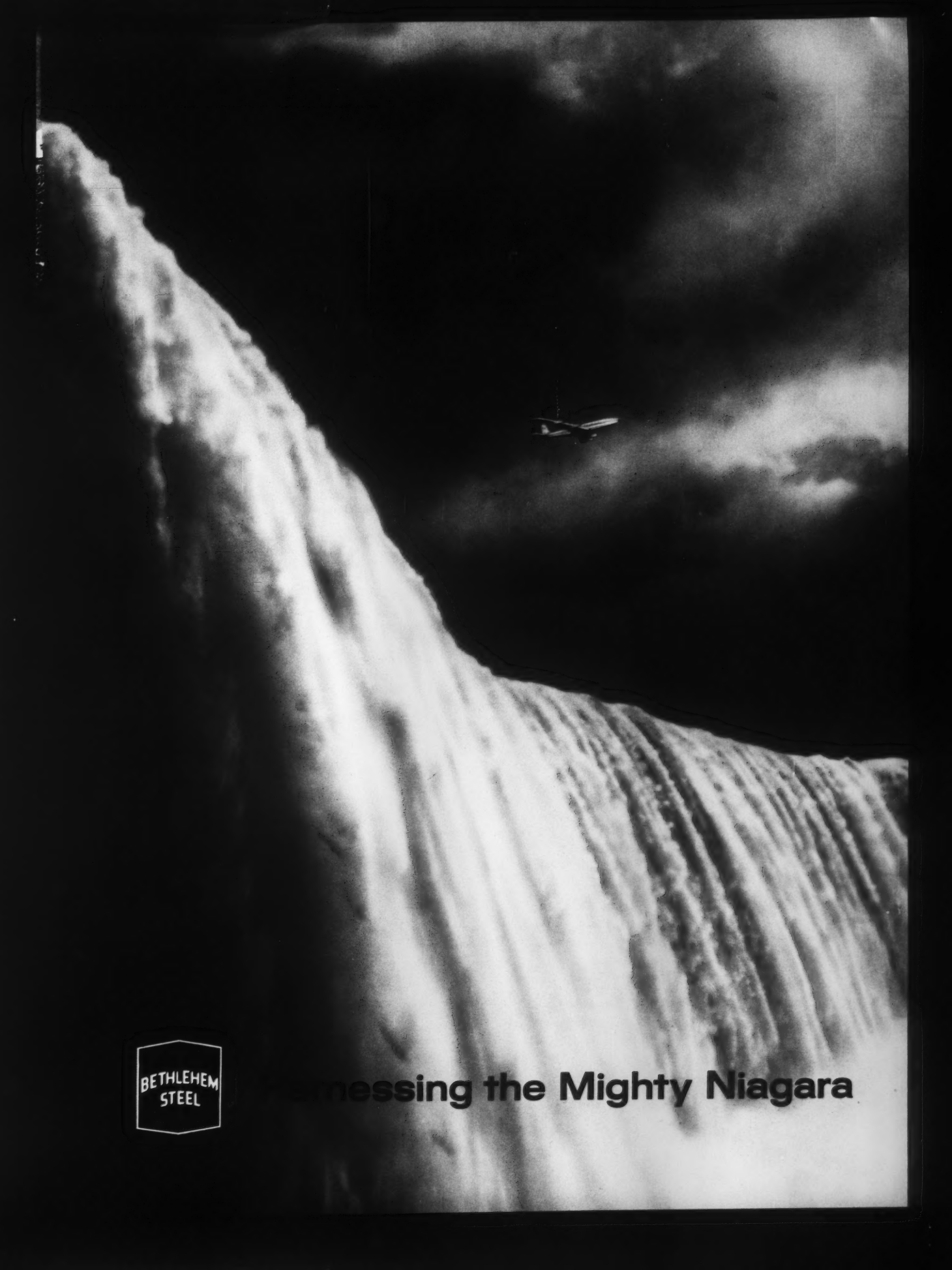
Willard W. Warzyn (left), president of the Wisconsin Section, introduces the first speaker of the evening Theodore F. Wisniewski, director of the Wisconsin State Commission on Water Pollution, at the Section's July meeting.

Dean Blodgett's talk dealt with the results of studies conducted at local and nationwide levels to determine the reasons underlying the reversal in engineering enrollment trends. The net decrease in engineering enrollment in the fall of 1958 has given educators a good deal of concern.

Members and guest attending a recent **San Francisco Section** meeting were treated to an excellent talk by Dean M. P. O'Brien, of the University of California, who discussed various aspects of civil engineering education. He stated that the primary purpose of an engineering school is the "development of a viewpoint" in contrast to matriculation in a science department where the hows and whys of nature's materials and forces are studied. U. S. schools emphasize a technical path in contrast to European schools which follow a professional path thereby giving a better proportioned emphasis to all phases . . . Lynn Seaman, who received only one grade below "A" during his four-year undergraduate career at the University of California, recently was awarded the University's highest scholastic honor. The medalist was secretary of the University of California ASCE Student Chapter. Under a General Electric Company graduate scholarship Mr. Seaman this fall will attend the Massachusetts Institute of Technology . . . The Section's Construction Division is in the midst of its most successful year, as gauged by interest and attendance at meetings. At the most recent meeting, Robert O. Wilhelm, attorney and registered civil engineer, discussed legal problems related to construction and engineering before a capacity crowd.

New Officers for Georgia Tech Student Chapter

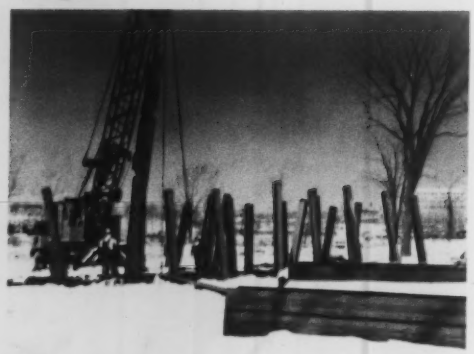
At the helm of the Georgia Institute of Technology Student Chapter for the coming academic year will be this new slate of officers. In usual order they are Prof. John O. Eichler, Faculty Adviser; Ritchey Marbury, St. Patrick's Council representative; Cecil Green, vice-president; Ralph Blythe, president; Prof. G. M. Slaughter, Assistant Faculty Adviser; Don Banks, secretary; Ed Glover, alternate representative to St. Patrick's Council; and Larry Dillard, treasurer.


BETHLEHEM
STEEL
nessing the Mighty Niagara

Twin conduits will shoot Niagara's water to 1,950,000-kw power house below Falls

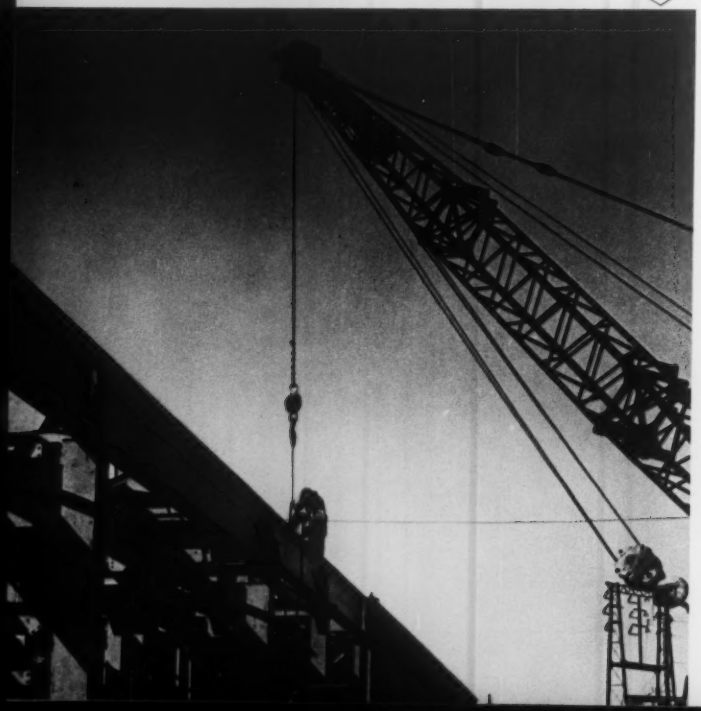
BETHLEHEM STEEL

One of the world's most ambitious power projects—harnessing the maximum potential of the American share of the Niagara River—is now underway in the Niagara Falls area. Known as the Niagara Power Project, it is being built under the direction of the Power Authority of the State of New York.



These Bethlehem H-Piles, being driven to bedrock, will provide firm support for highway interchange near new American Rapids Bridge to Goat Island.

Plenty of muscle needed at this location. Bethlehem Wire Rope swings steel bridge section into position in vicinity of Tuscarora Pump-Generating Plant.



This steelwork is for temporary highway bridge near intake structures. Bethlehem also fabricated and erected six additional bridges for project.

Features of the Project

At the intake structures above the Falls, water will be diverted from the river. It will flow four miles through two 46 ft x 66 ft underground conduits and then through a mile-long open canal to a 1,950,000-kw power plant located several miles below the Falls.

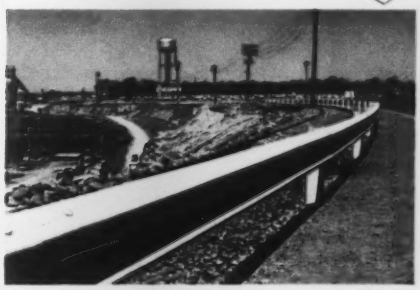
At night, during off-peak hours, some of the power of the main power plant will be used at the pump-generating plant to pump excess water up 80 ft into a storage reservoir. There it will be held in readiness for use in periods of high daytime demand when, besides producing another 240,000 kw at the pump-generating plant, the stored water will flow down the canal to the main plant to produce even more power.

The main features of the gigantic construction project are: intake structures (see circle 1 on map) and Niagara Generating Plant (3), Merritt-Chapman & Scott Corp.; water conduits (2) Balf-Savin-Winkelman and Gull-De-Felice; Tuscarora Reservoir (4), aggregate plant and canal, Channel Constructors (Peter Kiewit, Morrison-Knudsen, Perini, Walsh); Tuscarora Pump-Generating Plant (5), Tuscarora Contractors (Arundel, Hunkin-Conkey, L. E. Dixon). Related phases include a scenic highway, the elimination of railroad grade crossings, a new International Bridge to Canada, and a new bridge to Goat Island which is being fabricated and erected by Bethlehem.

What effect will this activity have on the scenic grandeur of Niagara Falls? None at all to the casual observer. In daylight hours during the tourist season, 100,000 cfs must flow over the Falls, as stipulated in the Treaty of 1950 between the U. S. and Canada. At night, and also during the daytime in the tourist off-season, the flow may be reduced to 50,000 cfs.

Wagon drills, equipped with Bethlehem Hollow Drill Steel, bore blast holes in rock during construction of 4-mile ditch to hold the reinforced-concrete twin conduits.

Bethlehem Beam Guard Rail, mounted on steel posts, offers protection to motorists at site of new power plant, overlooking Niagara River.



This Bethlehem Crane Rail is in service in temporary high-level trestle, hundreds of feet above the Niagara River at Lewiston. Trestle also contains Bethlehem structural shapes.

BETHLEHEM STEEL

LARGEST REINFORCING BAR ORDER IN BETHLEHEM'S HISTORY—Typical scene showing installation of Bethlehem Reinforcing Bars along route of 4-mile conduits. Some 60,000 tons of bars are being furnished for the project. Bethlehem also is furnishing the gate wheels, axles, and sheave wheels for the gates and gate-hoist mechanism.

A COMPLETE LINE OF CONSTRUCTION STEEL

Structural Steel . . . full range of standard and wide-flange shapes

Construction Fasteners . . .

Standard Types—Bolts, Rivets, Nails, Spikes, Clevises, Turnbuckles, Timber Hardware, High-Strength Bolts

Specialty Types—Tie Rods, Anchor Bolts, U-Bolts, Special Fasteners

Wire Rope and Strand . . . for all construction uses . . . Stress-relieved Strand for prestressed concrete

Fabricated Steel . . . Bethlehem fabricates and erects steelwork for all structures

Highway Steels . . . Beam guard rail, bar mats, dowel joints, bridge rail, and many other highway specialties

Storage Tanks . . . every type of tank for water or fuel storage

Steel Piling . . . wide range of sheet and H-piling, and accessories

Open-Web Joists . . . Complete series of shortspan and longspan types

Bethlehem Slabform . . . formed sheets for poured concrete floors and roofs

Concrete Reinforcing Bars . . . All sizes, with excellent bending and bonding qualities . . . rolled from new-billet steel

Steel Pipe . . . Butt-Weld, Electric-Resistance Weld, and Electric Fusion-Weld in a full range of diameters

Galvanized Steel Sheets . . . for ductwork, roofing and siding, drainage pipe

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Export Distributor: Bethlehem Steel Export Corporation

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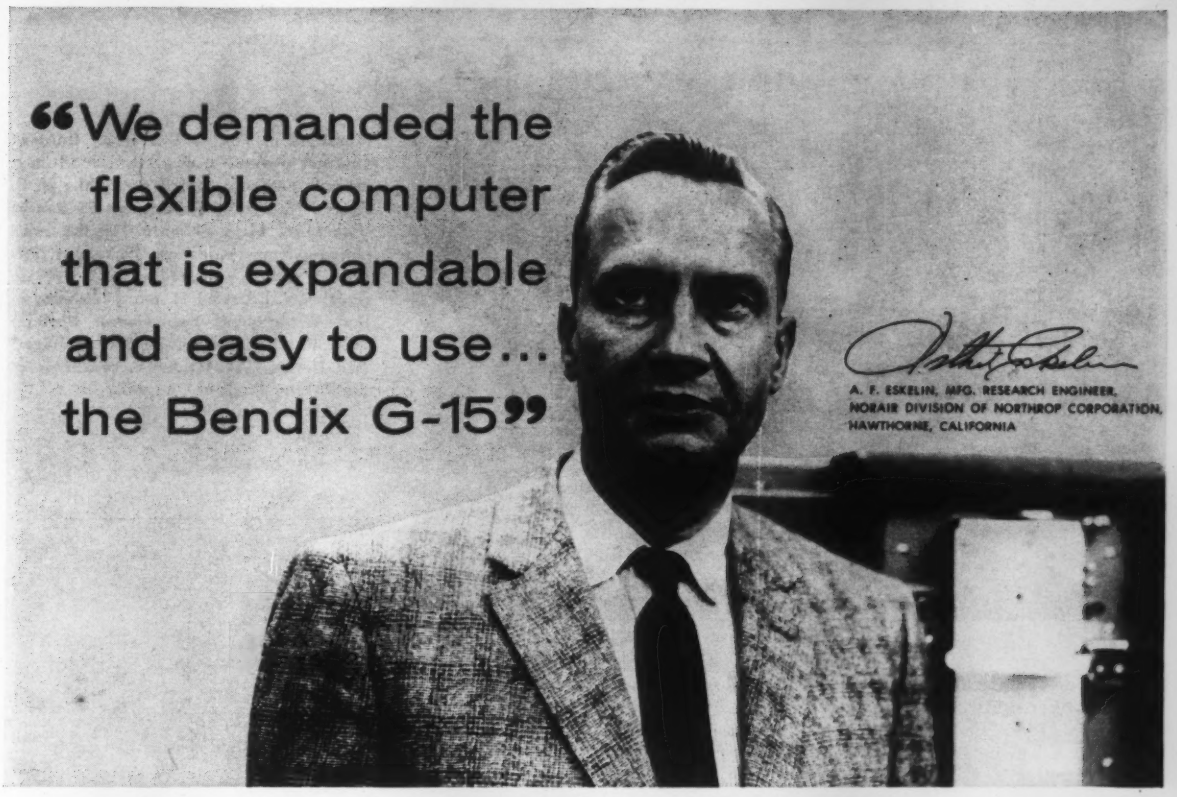
598, Printed in U.S.A.


"We demanded the flexible computer that is expandable and easy to use... the Bendix G-15"
A. F. ESKELIN, MFG. RESEARCH ENGINEER, NORAIR DIVISION OF NORTHROP CORPORATION, HAWTHORNE, CALIFORNIA

In the production of Norair's sleek new supersonic N-156 jet fighter, a low-cost computer was required. It had to provide extreme accuracy and reliability, yet be easy for engineers to program. And it would have to accept magnetic tape and punched paper tape.

"*Only the Bendix G-15 digital computer could meet these requirements,*" said Mr. Eskelin.

Hundreds of other users, with applications ranging from payroll accounting to the design of nuclear power plants, happily second Norair's choice.

Why so many pleased users? One reason is price. The G-15 is a medium-scale computer, yet costs no more than small-scale machines. Another reason is versatility. The G-15 will handle complex computing jobs in every type of business or industry.

You can start with the basic G-15, a complete operating computer in itself, with a unique photo-electric paper tape reader-punch and electric typewriter.

Then, add magnetic tape units, punched card equipment, multi-code paper tape readers, and other accessories as your work load expands and changes.

Simplified programming systems make the G-15 usable by your present staff, and hundreds of programs are available at no cost. Naturally, fast nation-wide service is available.

Complete details will be sent upon request. Mention specific problems where the G-15 may be helpful, and we will be pleased to advise you. Write to:

Bendix Computer DIVISION

DEPT. P-15
LOS ANGELES 45, CALIFORNIA

Members of Tulane University Student Chapter observe a simulated flood on a miniature Mississippi River at the U. S. Army Waterways Experiment Station in Vicksburg, Miss. Standing in the area showing where the new Vicksburg harbor is being constructed are (left to right) Col. Edmund H. Lang, director of the Waterways Experiment Station; Prof. Frank J. Dalia, Faculty Adviser; and Henry J. Lartigue, Jr., president of the Tulane Student Chapter.

The **South Carolina Section** had an all-day meeting recently, consisting of a tour of the Atomic Energy Plant at Aiken, S. C., a banquet, technical session, business meeting and luncheon. At the technical session Moses E. Cox, senior highway engineer, for Patchen, Mingledorff and Williams, Augusta consultants, spoke on highway engineering, and Don H. Mattern, ASCE Director for District 10, spoke on "You and Your Society." Main speaker at the banquet was Paul L. Holland, Vice President for Zone II. The **Central Savannah River Branch** acted as host.

Thirty-four members and guests attended a recent meeting of the **Knoxville Branch** of the **Tennessee Valley Section.** William Moehlman, past president of the Branch and president of the Tennessee Metal Culvert Company of Knoxville, spoke on professionalism in engineering. Pointing out that the professional attitude considers first the benefit and welfare of the public, Mr. Moehlman stressed the importance of registration as a means of developing the profession at a high level and eliminating those who are unfit by education and training to practice.

Section members from all over Wisconsin converged on the Fox River Valley for the July meeting of the **Wisconsin Section.** After renewing acquaintanceship with fellow engineers over a cocktail, the group was served a roast beef dinner. Stream pollution was the topic of the technical program. Theodore F. Wisniewski, director of the Wisconsin Commission on Water Pollution, discussed various aspects of the subject, particularly the history of the government's fight against pollution. Walter A. Sherman, who is the mill manager of the Flambeau Paper Division of the Kansas City Star Company, presented the paper industry's views on stream pollution. The brisk discussion which followed covered topics from fishing to sewage disposal. The Section gave Outstanding Student Awards consisting of Associate Membership dues in ASCE to Richard G. Mann from the University of Wisconsin, and Patrick J. Kelly from Marquette University.

ASCE CONVENTIONS

ANNUAL CONVENTION

Washington, D. C.
Hotel Statler
October 19-23, 1959

NEW ORLEANS CONVENTION

New Orleans, La.
Jung Hotel
March 7-11, 1960

RENO CONVENTION

Reno, Nev.
June 20-25, 1960

TECHNICAL DIVISION MEETINGS

SANITARY ENGINEERING CONFERENCE

Cincinnati, Ohio
Netherland-Hilton Hotel
January 8-11, 1960

Sponsored by
Sanitary Engineering Division

HYDRAULICS CONFERENCE

Seattle, Wash.
University of Washington
August 17-19, 1960

Sponsored by
Hydraulics Division

Delaware—Social hour and dinner meeting at the Tournier Memorial Hall, 1800 Howland Street, Wilmington, Del., October 13, at 6 p.m. President Francis S. Friel will be guest speaker.

Kansas City—Regional conference on construction at the Continental Hotel in Kansas City, Mo., November 12-13. The general conference theme will be "Mid-Century Construction . . . What's Right? Wrong? New?"

Los Angeles—Regular dinner meeting of the Sanitary Engineering Group at the Engineers' Club, September 23, at 6:30 p.m.; reception and dinner meeting of the Transportation Group at the Engineers' Club, September 22, at 6:30 p.m.; social hour and dinner of the Junior Member Forum at the Engineers' Club, September 24, at 6:30 p.m.

Metropolitan—Dinner meeting of the Associate Membership at Bob Olin on the Park Restaurant, Central Park West at 61st Street. Cocktails at 6 p.m., and dinner (roast chicken at $2.60 per person) at 7 p.m.

Sacramento—Weekly luncheon meetings at the Elks Club every Tuesday noon; regular dinner meeting of the Central Valley Branch on the fourth Wednesday of every month, at 6 p.m.

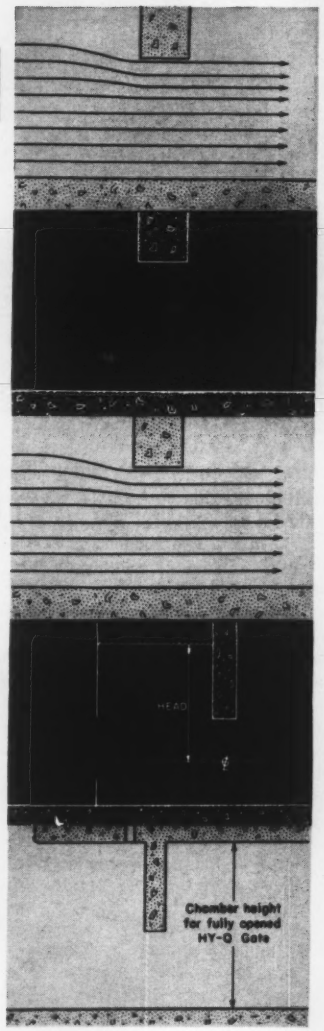
Tennessee Valley—Annual meeting at Knoxville, Tenn., November 13-14. The Knoxville Branch will be host.

Texas—Fall meeting at Fort Worth, with the Fort Worth Branch as host, October 1-3.

#6

SPECIFY RODNEY HUNT
HY-Q SLUICE GATES WITH FLUSH-BOTTOM CLOSURE
and get these 6 design advantages

HY-Q® Sluice Gates Mean Construction Economies



Because of the improved flow characteristics of the Rodney Hunt HY-Q sluice gate, a given volume of flow can be handled with a smaller gate size, narrower channel and lower channel walls than are required for a conventional gate. Thus there are often substantial economies effected in concrete construction. This improved flow is the direct result of the 5 other design advantages of the Rodney Hunt HY-Q sluice gate:

#1 HY-Q Sluice Gates Assure Maximum Flow

#2 HY-Q Sluice Gates Assure Complete Drainage

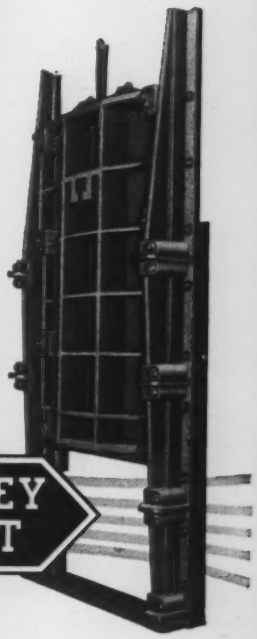
#3 HY-Q Sluice Gates Eliminate Interference with Flow

#4 HY-Q Sluice Gates Assure Maximum Hydraulic Gradient

#5 HY-Q Sluice Gates Permit Lowest Possible Invert

All these advantages derive from the design of the resilient seal fastened to the bottom of the disc. The seal extends the full width of the disc and provides a cushioned closing at the stop bar flush with the invert.

The HY-Q gate offers unmatched design flexibility and construction economy for water control projects . . . with hundreds of gate sizes available from 6" x 6" to 144" x 144" and larger to meet your specific design requirements.



HY-Q SLUICE GATE
a product of
RODNEY HUNT MACHINE CO.
Water Control Equipment Division
86 Water Street, Orange, Mass.
Serving water control engineers with equipment and engineering

RODNEY HUNT

BY-LINE WASHINGTON . . . . . .

Engineers should pay attention to growing criticism in Congress of what Congressmen are beginning to hint is deliberate under-estimation of the cost of construction. Temperatures and tempers were getting hotter in the Capital as August and the session drew to a close. But that criticism shouldn't go unheeded. It could mean trouble for construction agencies and for engineers later.

Vocal on the subject was Washington's Congressman Don Magnuson, who expressed his exasperation with the "apparently unchangeable" custom of underestimating the cost of construction projects. "The new Air Force Academy is a classic example," said Mr. Magnuson. "When we were asked to approve this glass castle . . . we were told it would cost $125 million. But the Academy is going to cost at least $200 million. Costs have risen in the interim . . . but an underestimate of these proportions cannot be explained away quite so glibly.

"We on the Appropriations Committee take it for granted that when the Bureau of Reclamation or the Corps of Engineers gives us a cost estimate on a project, we will not recognize the figure a few years later. . . . There is no real excuse for mistakes of this size."

* * *

President Eisenhower's proposal for promotion to Lieutenant General for Army Chief of Engineers Emerson C. Itschner, F. ASCE, is an expression of the Chief Executive's regard for a fine officer, and was hailed in Congress as a deserved promotion. Three Corps of Engineers chiefs have reached three-star rank—Generals Pick, Wheeler, and Sturgis.

* * *

The General Services Administration has been pushed to reexamine its bidding specifications concerning experience qualifications of contractors on federal buildings.

Senators (led by Arizona's Goldwater) objected strongly to GSA specifications containing such wording as: "The bidder shall submit with his bid a list of not less than three projects satisfactorily performed by the bidder, with his own organization, within the past five years (involving work of a similar type and similar to or greater in scope than that in these specifications.)" Senator Goldwater's complaint was that such specifications eliminate some bidders who, he said, might be perfectly competent, but can't show comparable work, even though they can show financial and other responsibility.

* * *

Forces are again at work to get the metric system adopted as standard for U.S. weights and measures. Newest evidence is a bill (S. 2420) by Oregon's Senator Richard Neuberger. Put over until next session, the measure directs the Commerce Department to make a three-year study to determine: (1) Standards and comparative advantages of weights and measures currently used in engineering, science, manufacturing, and education; (2) benefits the U.S. might derive from general adoption of the metric system; and (3) practical difficulties in achieving general adoption of the system.

* * *

Adding to competition for civil engineering graduates, the Navy's Bureau of Yards and Docks has announced a five-year recruitment program, aimed at filling the growing number of vacancies caused by retirements, transfers, and resignations. The first move will be enrollment of 27 engineering and architectural graduates who are now participating in the BuDocks' 1959 Professional Development Program at Arlington, Va. In addition, efforts will be made to sign up 13 summer student trainees and some professional employees who are receiving special training in engineering programs of the agency. Next will be active recruitment in engineering schools throughout the nation.

* * *

The Asphalt Institute, pushing to refine asphalt specifications, has announced the scrapping of its Loss on Heating Test and replacement of the test with what it calls the Thin Oven Test. This test is designed primarily to show whether heating results in significant loss of penetration. In a new publication, "Advanced Design Criteria for Asphalt Furnaces," the Institute strongly recommends inclusion of an asphalt base in addition to a 4-in. minimum thickness of asphalt concrete in the surface and binder courses, each compacted to 100 psi or more.

* * *

Details must still be worked out—but a system of modular construction for schools is feasible, according to the U.S. Office of Education. The conclusion was based on a recent meeting of a team of school construction researchers and school organizations. The research program is part of a three-year, federally financed project, scheduled to be completed in 1960.

Some 125 current school designs by leading architects have been analyzed, plans for many types of schools in the U.S. studied, and school administrators queried on the use of the buildings. Data include class of construction; type of corridor loading, building cross section, dimensions and shapes of classrooms; corridors; sanitary arrangements; manufactured elements, such as windows, partitions, and roof and wall panels. The project is being conducted for the Texas State Education Agency at Austin, with the cooperation of the Southwest Research Institute of San Antonio.

* * *

The long-planned study of fire safety in elementary and secondary schools has gotten underway, under sponsorship of the National Academy of Sciences (the Building Research Advisory Board and the Committee on Fire Research). Its objective is to produce a "clear and current guide" to major considerations of school fire safety, for use of school boards, educators, architects, and municipal planning agencies.

The committee is headed by an architect—Norman J. Schlossman, of Chicago—and includes another architect, two educators, a representative of the Los Angeles Fire Prevention Bureau and of the U.S. Bureau of Standards and of the U.S. Chamber of Commerce. No civil engineers are listed among committee members, nor is ASCE included in the list of organizations invited to cooperate in the study.

NEW-

Tow it into place

. . . Weir Contracting Co. tows their Heltzel Unitized, Mobilized Batching plant from previous job site on its own transportation wheels . . .

Heltzel's new 100 and 150-ton, pushbutton batching plants are now *unitized* and *mobilized* for easier moving—for faster setup—for greater savings of time and money.

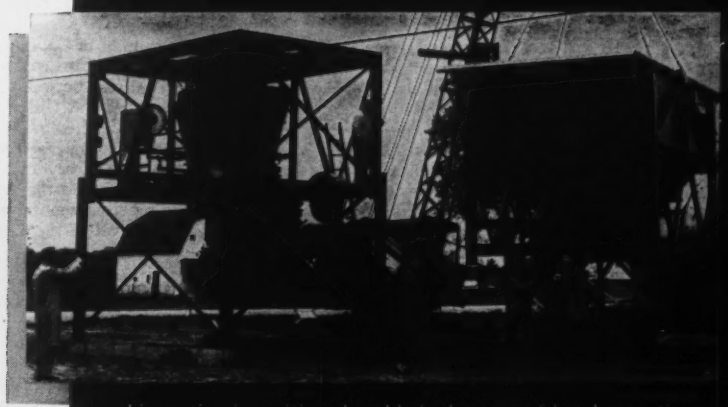
The new plant consists of two self-contained mobile sections; hopper section and batcher section (including scales) with new fold-up supporting columns. Both sections have built-in wheel assemblies and towing tongues—ready to roll.

Weir Contracting Company of Detroit, Michigan reports: "... Our first job was in Greenbrier Meadows Subdivision, Livonia, Michigan. After the plant arrived on the site it was ready for operation in a very few hours. We found that the speed of batching will give two complete batches in thirteen seconds. On subsequent work, the plant was dismantled and ready for transportation in two hours and towed by small, single axle dump trucks to the new location. We have found that the built-in transportation wheels save us over $100.00 a move because of not having to rent trailers."

For complete data and specifications contact your nearby Heltzel representative—or write us direct.

Set it up fast

. . . batcher section is raised into position, hinged columns are lowered and bolted in place . . .



. . . bin section is positioned and bolted on top of batcher section

Start batching

In just a few hours this full size, high capacity, pushbutton paving plant is ready to operate!

THE HELTZEL STEEL FORM AND IRON COMPANY

WARREN, OHIO

NEWS BRIEFS . . .

Water: America's No. 1 Problem, Says AWWA

Willing Water, the impish little service symbol of the American Water Works Association, made its appearance in the hotels, streets, and restaurants of San Francisco, worn on the lapels of hundreds of water-works executives and engineers during the AWWA's 79th annual convention, July 12-17. More than 3,100 attended. They were housed in four-score of the best hotels and motels of that air-conditioned convention city. There, in its civic center, the huge Civic Auditorium was given over to a week-long forward-looking program of technical sessions, committee meetings, and an amazing display of water-works tools, materials, and equipment arranged for the edification of the conventioneers by the Water and Sewage Works Manufacturers' Association.

San Francisco's Mayor George Christopher personally welcomed the AWWA to his city, pointing out that water is California's most precious commodity—more precious than was its gold or its oil. He said that San Francisco over the years has spent $400 million on its own water-works system, and that California now has a $12 billion state-wide water-supply system in the making. His official proclamation, setting aside the week as "American Water Works Week in San Francisco," declared that AWWA's progressive program has been "instrumental in increasing the public's appreciation of everything that public water supply means to urban life and development."

In response, President Lewis S. Finch, F.ASCE, of Indianapolis, said that the convention theme would be, "Water: America's Number One Problem." He addressed himself to discussing the present needs of the water utility field and stated that the AWWA has developed a program to promote better public appreciation of water service. Rates for water and salaries of managers and employees should be adequate, he declared. Water is priceless. Never should we brag that water is "cheap"—that has the connotation of being "no good." Rather it is a low-priced product with rates lower than the rates for electricity, telephones, or gas.

People Must Be Informed

Added recently to the AWWA staff as Director of Water Utility Advancement is James B. Corey. The purposes of this publicity program are: (1) To develop improved public understanding of water needs through effective community relations programs, and (2) to advance professionally present and potential water utility managers through management education. Mr. Corey moderated a panel discussion related to this new program which included Woody M. Jorgensen, assistant to the vice-president of the Pacific Telephone and Telegraph Company. He said, "Like an individual, a utility must be a good citizen. It needs to let the public know what the utility is doing for the community."

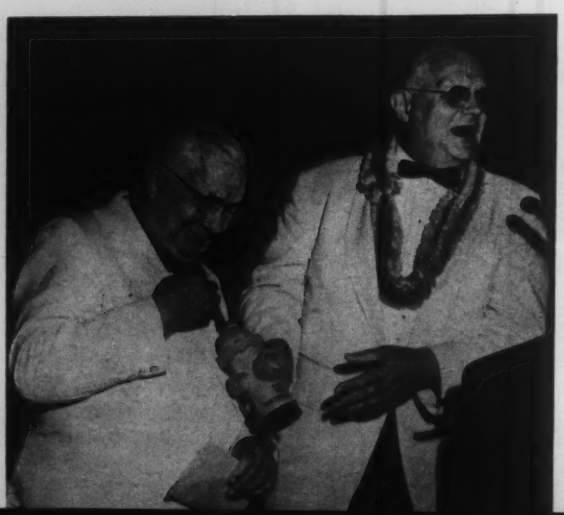
Robert Gros, vice-president of the Pacific Gas and Electric Company, and another panel speaker, pointed out that our economy has changed from one that can be characterized as having "two cars in every garage" to one that can be designated as having "a swimming pool in every yard." Another panel speaker, John Taylor, national vice-president of the Junior Chamber of Commerce, announced that his organization had adopted a plan of cooperation between local Jaycee groups and AWWA Chapters designed to acquaint local citizens with their own water problems and their water development needs by means of panels of local-citizen speakers and the use of films.

At the opening general session, Horace B. McCoy, head of the Business and Defense Services Administration, emphasized the scope of the government's interest in water resources, flood control, and the disposal of liquid wastes. He pointed out, first, that most businesses do not take advantage of the very considerable economic data available in the Department of Commerce for the asking and, second, that the Water and Sewerage Industry and Utilities Division of BDSA, headed by Walter L. Picton, M.ASCE, needs the support of all water-works men in order to continue its usefulness. In explaining this need, he related that an unnamed congressman once opposed the appropriation of money for the Weather Bureau by saying, "Anyone can read the weather report in the morning paper."

F. H. Eastman, secretary of the East Bay Municipal Utilities District, outlined the program developed recently by the District in obtaining a 4:1 vote in favor of a $252 million bond issue involving a million citizens residing in the thirteen communities in the district. The bond issue provided funds to construct a third pipeline from the Mokelumne River source to the East Bay area.

Engineering is not all technical, said William J. Orchard, of New Jersey. It required "human engineering" to overcome 25 years of citizen apathy and frustration for the water-works men to get a self-supporting and self-liquidating water plan for New Jersey approved by the voters. The $45 million bond issue, passed in November 1958, makes funds available for an off-river pump-storage reservoir in Round Valley to provide 300 mgd, and a small reservoir on the Raritan River to provide an additional 110 mgd. Under the plan adopted by the voters New Jersey is to go into the water business on a wholesale basis only.

On May 29, 1959, the state legislature passed the California Water Resources Development Bond Act and adopted the California Water Plan, M. J. Shelton, F.ASCE, of San Diego, former deputy director of the California Division of Water Resources, told the convention. The plan calls for the construction of more than 375 dams and reservoirs, and 5,000 miles of canals and pipelines that will cost ultimately over $12 billion, the largest water project ever undertaken by any of the states. The cost of the project is to be paid by the users of the water and the power developed. The next step in this project—unprecedented in size and extent—is to submit for voter approval in November 1960 a $1.75 billion bond issue for the construction of Feather River Dam, a 725-ft-high multi-purpose rolled-earth and graded-gravel-fill structure, and of an aqueduct system for conveying water to the San Joaquin Valley and to Southern California. The estimated cost of water delivered is about $50 per acre-ft.



Harry E. Jordan (left), who retires in September after 23 years as secretary of the AWWA, receives "Mr. Water Works" emblem from Lewis S. Finch, retiring AWWA president, at the "Salute to Harry E. Jordan Dinner," a highlight of the 79th annual convention.

New Water Sources Studied

Fred A. Seaton, Secretary of the Interior, recalling America's explosive population growth, said that the demand for added water supply will lead to the use of brackish or sea water to obtain usable water by distillation. The cost of this now approaches $1 per 1,000 gal ($327 per acre-ft), but one day, he said, the cost will come down to equal that of surface waters now becoming more costly to obtain. The Secretary announced that the government's first demonstration plant, a 1-mgd long-tube vertical-effect distillation facility (W. L. Badger Co.) will be located at Freeport, Tex., about 2 miles from the ocean near the Dow Chemical Company's intake. A second 1-mgd plant is scheduled for the coast of California somewhere between San Diego and Monterey. This is to be a multi-stage flash distillation plant with an atomic reactor as the heat source.

Considerable attention was given not only to weather forecasting but also to the possibility of modifying the weather so that rainfall and runoff can be increased in specific regions. With 25 years of experience behind him, Dr. Irving P. Krick, of Denver, told how his firm has been able to project stream runoff a year ahead based on historic data of barometric pressure patterns, with a usual accuracy of 3 to 5 percent. High-speed electronic computing equipment is required to handle the data. He explained that hydro-power companies need to know with reasonable certainty whether reservoirs can be drawn down in the fall in anticipation of a following wet year. The possibilities of global weather control are excellent, Dr. Krick predicted.

Discussion developed opposing viewpoints about the value of cloud seeding. Robert S. Millar, secretary-manager of the Denver Water Board, reported that statistical proof of the value of cloud seeding in that area in 1950-1955 could not be developed. Paul Beerman, F.ASCE, director of the San Diego Water Department, said that of six tries at increasing rainfall in that area, only once did there seem to be an increase. On the other hand, Morrison B. Cunningham, director of public works of Oklahoma City, said that his experiences with weather modification had been good—worth the cost. He stated: "A few years ago we asked 'will it work?' Today it is asked, 'How well will it work?'"

Reduction of evaporation from reservoir surfaces by applying a compressed layer of hexadecanol one molecule thick has been under study at Lake Hefner, Oklahoma, by the Bureau of Reclamation. Walter U. Gorstka, engineer with the USBR, reported that over the test period, July 7 to October 1, 20 tons of hexadecanol had been applied to the lake surface. Only a part of the lake could be covered at any one time. The film lasted but two days at best, being subject to destruction by chemical, mechanical, and biological effects. Wind was the chief wrecker of the film. At 65 cents per pound the hexadecanol (made chiefly from whale blubber) treatment is costly—about $61 per acre-ft of water saved. Nevertheless, the savings were estimated at 9 percent. More complete data on the Lake Hefner tests are available from Grant Bloodgood, F.ASCE, assistant chief engineer, U. S. Bureau of Reclamation, Denver Federal Center, Denver, Colo.

Speaking on the program of the Purification Division John R. Baylis, F.ASCE, long-time purification engineer for the City of Chicago, explained that his city is faced with rebuilding 80 rapid sand filters in the 320-mgd South District Filtration Plant. Both 30 years of experience and the results of recent experiments have convinced Mr. Baylis that a new arrangement of the gravel layers in a filter may eliminate clogging and mounding difficulties resulting from back washing the filter. The gravel in one large filter has been regraded and has been in satisfactory operation since June 1959. Rebuilding other filters will await the results of actual experience with the rebuilt unit.

Honors Awarded

Honorary memberships were awarded to Frank C. Amesbury, F.ASCE, of Long Island; E. Sherman Chase, F.ASCE, of Boston; Morris S. Jones, F.ASCE, of Pasadena; and M. C. Smith of Richmond, Va. To Fred Merryfield, F.ASCE, of Oregon State College, went the John M. Diven Medal; and to Louis R. Howson, Past President ASCE, of Chicago, went the John M. Goodell Prize for his paper, "Factors Affecting Long-Distance Transmission of Water."

During the convention outgoing president Lewis S. Finch, F.ASCE, of Indianapolis handed the gavel to incoming president Lauren W. Grayson, F.ASCE, of Glendale, Calif.

Another highlight of the week was a salute by the water works industry at the annual dinner to honor its one-time president, Harry E. Jordan, Aff.ASCE, who is retiring on September 1 as executive secretary after 23 years of effective service to AWWA and more than a half century devoted to the water works field.

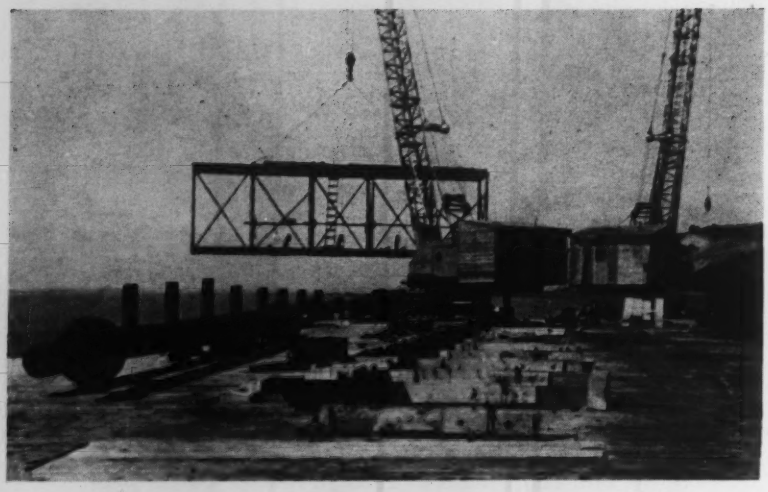
New Mississippi River Bridge Nears Completion

This airview of the new Iowa-Illinois Memorial Bridge (right), which will span the Mississippi River near Davenport, Iowa, was taken just before a 53-ft eight-ton truss closed the steel between the abutments, a distance of 5,017 ft. The new bridge, which is being constructed for the Davenport Bridge Commission, was fabricated and erected by the Bethlehem Steel Co. It practically duplicates an adjacent bridge built by Bethlehem in 1935. Scheduled for completion later this year, the new river crossing will have a main suspension span of 1,480 ft. It will be the 39th major highway crossing of the Mississippi between St. Paul and New Orleans. Engineers for the Bridge Commission are Modjeski & Masters, of Harrisburg, Pa.

Chicago Hotel to Amplify Facilities

This August construction started on a 25-story, 600-room addition to Chicago's Sheraton Towers Hotel. The George A. Fuller Company has the contract for the $8,000,000 project, which will more than double the present facilities of the Sheraton Towers, one of Chicago's leading convention hotels. The project will include a four-level garage, featuring a drive-through entrance on lower Michigan Avenue that will directly connect the hotel with city and state superhighways. The completion date is set for February 1, 1961.

Architects and engineers for the project are E. F. Quinn and R. T. Christiansen, of Chicago, in cooperation with Fred S. Kummer, senior vice-president of engineering for the Sheraton Corporation of America.



Modern Marine Terminal for Anchorage, Alaska

Construction of a modern marine terminal for the City of Anchorage is underway. The structure will consist of a wharf and transit shed, supported on steel pipe piles varying from 16 to 48 in. in diameter. Economic design is achieved by using pedestal-type bearing shoes, which can be seen on the piles in the foreground. These pedestals develop the 120-ton pile design capacity with a safety factor of 2 at 20-ft embedment. Several unusual environmental conditions affect the design. A 40-ft tidal variation requires a deck to harbor bottom-pile span of up to 75 ft. In the rugged winters, a 20-ft thickness of ice is expected to adhere to the piles, alternately applying weight and buoyancy to the structure. Ice floes moved by wind and tide are also expected to endanger the structure. Design and supervision of construction are by Tippetts-Abbett-McCarthy-Stratton. The DeLong Construction Co. is the general contractor.

Ground Is Broken for Verrazano-Narrows Bridge

On August 13 ground was broken for the $320,000,000 Verrazano-Narrows Bridge, connecting Staten Island and Brooklyn, in ceremonies headed by Governor Robert Meyner of New Jersey and Mayor Robert Wagner of New York. The crossing, which has been under study since 1955, will be opened to traffic in 1965. It is a joint project of the Port of New York Authority and the Triborough Bridge and Tunnel Authority. The Port Authority is undertaking $30,000,000 of initial financing and the acquisition of properties within the military reservations of Fort Wadsworth and Fort Hamilton.

The twelve-lane double-deck suspension bridge will extend nearly three miles —from 92nd Street near Fort Hamilton Parkway in Brooklyn to a point just west of Fort Wadsworth on Staten Island. With a 4,260-ft center span, it will be the world's longest suspension bridge. Each of the side spans will be 1,215 ft long. Central clearance over the channel will be 228 ft, permitting the largest ships to pass.

In connection with the project, New York State will build a seven-mile highway, called the Clove Lakes Expressway. This route across Staten Island will link the bridge with the Goethals Bridge, forming a direct connection with the New Jersey highway system. The Gowanus Expressway, to be built on the Brooklyn side, will link the bridge with the Gowanus Parkway, the Brooklyn-Queens Expressway, and the Brooklyn-Battery Tunnel.

Present plans call for completing the lower level of the bridge and the Staten Island and Brooklyn expressways by 1965. The upper level and approach ramps will be built when additional capacity is needed. In the first full year of operation, the bridge is expected to handle 16,300,000 vehicles. The estimated annual capacity of the bridge, with both levels in use, is 48,000,000. It is expected that this capacity will be reached by 1981.

New Port to Be Built in Ecuador

Work is starting on construction of a new port at Guayaquil, Ecuador, following the award of a $16,500,000 contract to Raymond International, Inc., of New York. The new port is expected to stimulate Ecuador's export trade and reduce the cost of imports by permitting large ocean-going ships to reach Guayaquil and by cutting down turnaround time. The project is scheduled for completion in 1962.

Though the present port of Guayaquil is the largest in the country, it is very inadequate because of the geography of the area. The Guayas River, on which present facilities are located, is subject to serious floods, strong currents, and dangerous shoaling, with the result that most deep-draft cargo must be transferred to lighters 40 miles below the city. Since the cost of dredging the river would be prohibitive, an entirely new port will be built six miles below the city on Estero Salado, a major estuary of the Gulf of Guayaquil. The project consists of three major parts: the port itself, a dredged channel in Estero Salado, and a barge canal connecting the new port with the Guayas River. More than 16,000,000 cu yd of dredging will be required.

The consulting engineers on the project are Palmer and Baker of Mobile, Ala., and the owner is the local port authority, Autoridad Portuaria de Guayaquil.

June Housing Starts At Nine-Year High

Nonfarm housing starts rose from 134,000 in May to 136,000 in June, according to preliminary estimates of the Bureau of the Census of the U. S. Department of Commerce. This is contrary to the moderate seasonal decrease usually occurring between May and June. The total of June 1959 starts for privately and publicly owned units was 20 percent greater than a year ago, and the highest recorded for any June except in 1950.

The 131,200 privately owned dwelling units begun this June represented a seasonally adjusted annual rate of 1,370,000 —up slightly from the estimated rate of 1,340,000 for May, but somewhat below the seasonally adjusted rate of 1,390,000 for April. When averaged for the first six months, the seasonally adjusted annual rate of private starts in 1959 amounted to 1,378,000 units, compared with the relatively low rate of 989,000 for the same 1958 period.

By the end of June 1959, a total of 709,500 new private and public dwelling units had been put under construction, an advance of 32 percent over the first six months of 1958, and the highest for the six-month period in any year. The private total for the period (690,700 units) exceeded by 192,700 units the private total for the first six months of 1958.

Starts in publicly owned projects totaled 18,800 thus far in 1959, against 38,000 begun during the first six months of 1958, and 28,300 in the same period of 1957.

UNESCO Conference To Be Held in Denver

The seventh national conference of the U. S. National Commission for UNESCO (United Nations Educational, Scientific, and Cultural Organization) will focus attention on achievements in education, science, and the arts in the Latin American republics. The conference will be held in Denver, Colo., September 29-October 2. The conference theme will be carried out in major programs on Education, Science, and Culture, with additional sessions devoted to balanced economic growth and international organizations.

Inquiries should be addressed to Sterling Fisher, Chairman of the Committee on Public Information for the Seventh National Conference, c/o *The Readers Digest*, 230 Park Avenue, New York 17, N. Y.

ASCE Past-Presidents Gail A. Hathaway and Carleton Proctor are among Society members planning to attend. Mr. Proctor is expected to attend in his capacity as EJC representative on the U. S. National Committee for UNESCO.

Aluminum Construction Manual Available

The Aluminum Construction Manual, just off the press, provides in a single volume data essential to designers and others concerned with stressed aluminum structures. Published by the Aluminum Association, an industry-wide organization, the book presents for the first time computations of allowable loads for beams and columns of aluminum alloy 6061-T6, one of the most widely used aluminum structural alloys.

Fundamentally a reference work, the first part relates to available aluminum structural shapes, giving their dimensions, weights, and properties. Included also are the standard tolerances and miscellaneous data necessary for designing and estimating. This is followed by detailing practice and data on riveted and bolted connections.

A section covers the hitherto unavailable material for beams and columns produced in alloy 6061-T6. The data for various types of laterally supported beams and concentric loads on columns were computed by the Polytechnic Institute of Brooklyn. The work was supervised by R. B. B. Moorman, F. ASCE, head of the Civil Engineering Department.

Data are given on nine alloys that fulfill most structural needs. Found here are the specifications for structures of two commonly used alloys (6061-T6 and 2014-T6) as issued by ASCE.

Making dependable data needed for design readily available is expected to increase use of the light-weight metal. The book is available at cost of printing—$3.00 per copy—from the Aluminum Association, 420 Lexington Ave., New York 17, N. Y.

Seasonal Rise in Construction Reported for July

The value of new construction put in place in July was up seasonally to $5.2 billion, according to preliminary estimates of the Bureau of the Census of the U. S. Department of Commerce. This represented an increase of 3 percent over June and of 14 percent over July 1958. The total value of work put in place in the first seven months of 1959 was $30.1 billion, an increase of 15 percent over the same period of 1958.

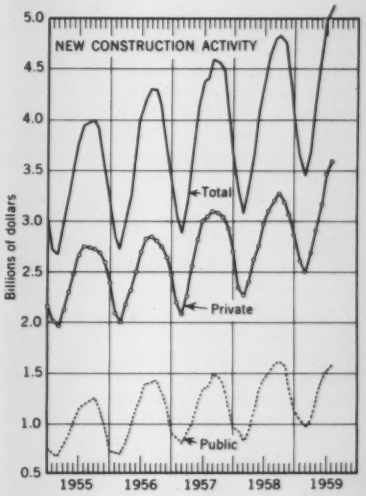
The physical volume of new construction put in place in the first six months of 1959 is estimated to be 13 percent above the volume for the corresponding period last year.

Outlays for new private construction rose seasonally in July to $3.6 billion. They total $21.2 billion for the first seven months of 1959—16 percent higher than expenditures in the first seven months of 1958. New residential construction, which showed no appreciable seasonal change in July, accounted for the 1959 increase in private construction with a 32 percent expansion over the first seven months of 1958—from $9.3 to $12.3 billion. Expenditures for nearly all other major types of private construction showed greater than seasonal increases in July.

Outlays for public construction showed a normal rise in July to $1.6 billion. For the first seven months of 1959, the value of work put in place was $9 billion—12 percent above the same period in 1958. The increase resulted chiefly from accelerated expenditures for highways, military facilities, and public residential building.

These monthly estimates are primarily derived by applying standard progress patterns, which include assumed normal seasonal factors, to the value of contracts awarded prior to the current month. Except in the case of special surveys, the estimates do not reflect the effects of the varying number of working days in different months, nor of special conditions influencing the volume of activity in any given month, such as unusual weather, materials shortages, overtime, work stoppages, and postponements.

[*Effective July 1, responsibility for compiling the monthly construction estimates was transferred from the Business and Defense Services Administration of the Department of Commerce and the Bureau of Labor Statistics of the Department of Labor to the Bureau of the Census of the Department of Commerce.*]



Seasonal rise in new construction put in place in July brings total for month to $5.2 billion—an increase of 3 percent over June and of 14 percent over July 1958.

Sacramento River Bridge Built in Stages

Sequence of work is important in keeping traffic moving over and under this California Division of Highways bridge over the Sacramento River at Rio Vista. Seven spans at the right were completed in 1946 and connection made to the old bridge (foreground) for crossing the navigation channel. For the Sacramento Deep Water Channel, the U. S. Engineer Department set the new movable span location nearer the center of the river. Under a $2,300,000 contract the Judson Pacific Murphy Corporation has constructed a new vertical lift span and is completing the bridge. Highway traffic is being rerouted across the lift span while the old structure at the new navigation channel is removed. When the new bridge is completed the rest of the old structure, with its double-leaf bascule span will be removed. (Data and picture from F. W. Panhorst, F. ASCE, and I. O. Jahlstrom, both of the California Department of Public Works.)

Cooper Union Conference on Engineering Education

Future trends in civil engineering education were studied at a recent meeting of engineering education leaders, held in New York City under the sponsorship of the Cooper Union for the Advancement of Science and Art. The group agreed that additional study of civil engineering education is a must, in order to reverse decreasing enrollments and to attract better qualified students to the field. Questions to be answered, if civil engineering is to maintain its identity as an undergraduate curriculum, were formulated. These include the following:

Should civil engineering be eliminated at the undergraduate level and taught in a professional school? Should undergraduate curricula be extended to five or more years? Should undergraduate curricula be the same for all engineers with a few specialized departmental courses available in the last year? Should bifurcated programs be offered, one heavily weighted towards science and the other towards the technological?

Using the report of the ASCE Task Committee on Civil Engineering Education as a springboard, the conference discussed the broad humanistic, technical, and professional aspects of civil engineering. It was decided that an undergraduate program devoted solely to engineering science would not serve the best interests of future civil engineers, since the civil engineer must draw heavily on synthesis and experience in the design of his projects. Some members of the conference expressed concern as to the best undergraduate education for the highly capable students who will go on to graduate work. Such students must be subjected to a curriculum that provides the tools of analysis and synthesis at the highest level possible.

Because of the complexity of formulating recommendations for undergraduate civil engineering curricula, members of the conference agreed with a proposal of the Cooper Union School of Engineering to obtain financial support from the National Science Foundation for additional conferences. Both ASCE and the American Society for Engineering Education have accepted joint sponsorship with Cooper Union in this program. Cooper Union will undertake its share of the program as one phase of its centennial celebration, which will take place during the 1959-1960 academic year.

Guests of Cooper Union for the conference included Dean George F. Branigan, University of Arkansas; Dr. Charles E. Cutts, Michigan State University; Frank Edwards, manager, Stanley Engineering Co., Chicago; Dean Cornelius Wandmacher, University of Cincinnati; Dr. Benjamin A. Whisler, Pennsylvania State University; and Dr. J. B. Wilbur, Massachusetts Institute of Technology. All are Fellows, ASCE. Representing Cooper Union were Dr. John W. Graham, Jr., F.ASCE; Dr. Charles F. Peck, Jr., M.ASCE; and Dr. F. A. Wallace, M. ASCE.

Reinforced Concrete Floor Slabs Studied

Research currently underway at the University of Illinois is expected to provide the basis for more rational and consistent methods of design for the several types of reinforced concrete floor slabs now in use. The experimental and analytical program includes flat-plate, flat-slab, and two-way-slab types of construction.

The most outstanding feature of the project is that it involves coordinated and parallel tests on the two principal types of concrete floors now in common use: Slabs supported only at the columns, such as the flat plate or flat slab, and slabs supported on the four sides of each panel by beams spanning between the columns. Tests are being made on quarter-scale models of typical floor systems, each consisting of nine square panels arranged three by three. The panel size in the prototype floor is 20 by 20 ft.

The project is sponsored by the Reinforced Concrete Research Council of Engineering Foundation; the Office of the Chief of Engineers, U. S. Army; the Public Buildings Service of the General Services Administration; and the Directorate of Civil Engineering, Headquarters, U. S. Air Force. The development of new methods of analysis for continuous plates is being carried out under a grant from the National Science Foundation.

The technical aspects of the project are being guided by an Advisory Committee, consisting of representatives of the Joint ACI-ASCE Committee on Design of Reinforced Concrete Slabs, as well as of the various sponsoring agencies. L. H. Corning, F.ASCE, is committee chairman.

In photo, research assistant is seen attaching electrical resistance strain gages to the reinforcement over an interior column of the flat-plate, floor-slab model. The edges shown have deep spandrel beams. Columns are supported on reaction-measuring tripods.

NSF Support for Science Programs

Continuation of support for several important educational and scientific programs during the 1960-1961 academic year is announced by the National Science Foundation. These programs are: Undergraduate Research Participation; Research Participation for Teacher Training; and Science Training for Secondary School Students.

Colleges, universities, and other educational institutions wishing to consider participation in these programs are asked to address their inquiries to: Special Projects in Science Education, Scientific Personnel and Education, Washington 25, D.C.

First Nuclear-Powered Cargo Ship Launched

The world's first nuclear-powered passenger-cargo ship, the *N.S. Savannah*, was launched at the yards of the New York Shipbuilding Corporation, Camden, N. J., on July 21. The 595-ft merchant ship, which is being constructed under a joint contract with the Maritime Administration and the Atomic Energy Commission, will be ready for trial runs in the spring of 1960.

Named in honor of the first ship to cross the Atlantic under steam, the *Savannah* will be capable of carrying 60 passengers and 9,500 tons of cargo at a speed of 20½ knots. With a cruising range of 350,000 miles, it can go around the world twelve times without refueling. The advanced design pressurized water reactor and propulsion systems were designed and built by the Babcock & Wilcox Company under a separate contract with the Atomic Energy Commission. The *Savannah* will be operated under government contract by States Marine Lines.

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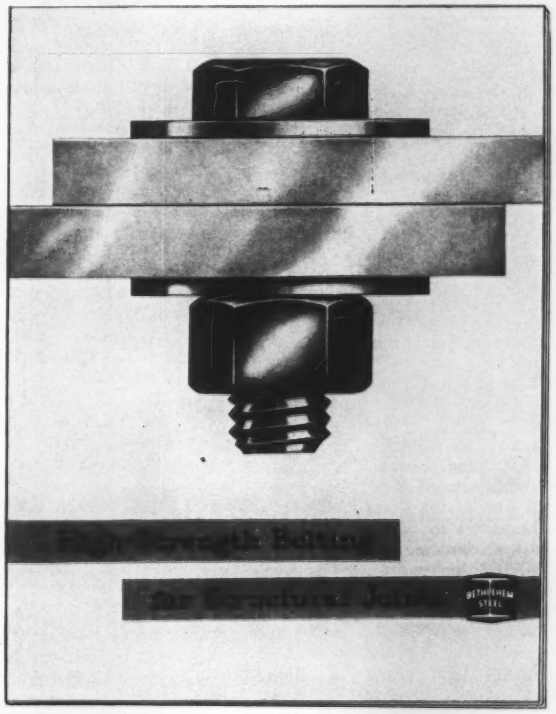

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Aluminum Dome Tops Las Vegas Convention Center

A 312-ft-dia aluminum dome crowns the new $6,000,000 convention center just completed in Las Vegas, Nev. The mushroom dome covers a circular assembly hall with seating capacity for 8,500, which will enable Las Vegas to accommodate major conventions. The dome was designed by Adrian Wilson and Associates, Los Angeles architects, with the aid of engineers from the Apex Steel Corporation, Ltd, of Los Angeles, the erectors, and the Reynolds Metals Company, the aluminum supplier. The Lembke Construction Company, of Las Vegas, was general contractor.

EXAM GEMS

by

Reggie Strashn

R. ROBINSON ROWE, F. ASCE

EXAMGEM No. 2 was one of a set of five from which any three could be chosen. Intended as an "equalizer" for field men, its simplicity attracted some young designers who didn't realize how much was purposely left unsaid. Let's read it again: *Construction materials must be trucked from a railway siding over a single lane road through an area which will require passing turnouts. The road is 10 miles in length. The road must be widened at specific points where the trucks will meet and pass. Assume the average speed loaded or unloaded to be 10 mph, and loading and unloading time to be 15 min with a single crew at each end of the road. Show all calculations.*

(*a*) *How many trucks can be efficiently operated?*
(*b*) *Locate the passing points.*
(*c*) *How many hr per day will loading and unloading crews be engaged? (Trucks are to operate as nearly an 8-hr day as possible.)*
(*d*) *When does the pay day begin and end for the loading crew, unloading crew, and the truck operators?*

Mr. A was a designer and a bright chap—maybe too bright. He added the steps of the cycle, 15+60+15+60=150 min= 2.5 hr. After the single crew had loaded 10 trucks, the first would be back for its second cycle, so there was the answer to (*a*). Easy. On a 15-min headway, trucks would parade 2.5 miles apart, but after you passed one you'd meet the next 1.25 miles farther on. So the passing points had to be at MP 1.25, 2.5, 3.75, 5, 6.25, 7.5 and 8.75. A snap, but you'd be surprised how many located 3 passing points 2.5 miles apart!

Mr. A took Part (*c*) in stride. The 8-hr optimum is nearer 7.5 than 10, so there had to be 3 cycles of 10 trucks, making 30 loadings at 15 min each, for a working time of 7.5 hr for the loading crew and the same for the unloading crew. For (*d*), he started things at 8 a.m. at the siding, staggered his truck operators by 15-min intervals, and started his unloading crew at 9:15 a.m. He tabulated the results in impeccable reinhardt, quitting each man 7.5 hr after his morning start. The last truck operated 10:15 a.m. to 5:45 p.m.

Mr. B was a detailer who prided himself on details. Like lunch. He shut down the parade of trucks from noon to 12:30, overlooking the long afternoon for the late starters. He put in a couple of coffee breaks, but brilliantly scratched them out. Then he underscored the word "efficiently" in Part (*a*) and scheduled 8 truck operators to handle 10 trucks by shifting each operator to the truck ahead during the loading and unloading operations.

Mr. C had cut his teeth on a left-handed monkey wrench. He knew that a driver lived with his truck—for loading unloading, servicing, and parking. That odd half hour was just about right. He also knew the pay day included the shift time plus overtime. He made the shift 8 a.m. to 4:30 p.m. with a half-hour for lunch, then split the overtime by starting to load at 7:30. The rest was just arithmetic.

Mr. D had worked for a contractor and knew all that C knew and a little more. He saw that the text didn't say where to locate the truck park. He could beat most of that overtime with either of two schemes. One would locate the truck park at the halfway point on the haul road, parking 5 *loaded* trucks every night. Then in a symmetrical operation next morning, the loaded trucks would start for the job when the unloaded trucks left for the siding, at 15-min intervals beginning at 7:30. Loading and unloading crews work the straight shift 8 a.m. to 4:30 p.m., with a half hour for lunch and a half hour for wind-up and lock-up at the end. Truck schedules range from 7:30-3:30 to 8:30-4:30, including lunch, all being paid for the shift and four drawing overtime. Some will service at night and some in the morning.

Just in case the halfway point was unavailable for a truck park, Mr. D outlined his second-best scheme—park 5 trucks at the siding and 5 loaded trucks at the job. Operations would be similar and symmetrical, being identical for loading and unloading, but with a little more overtime for truck operators.

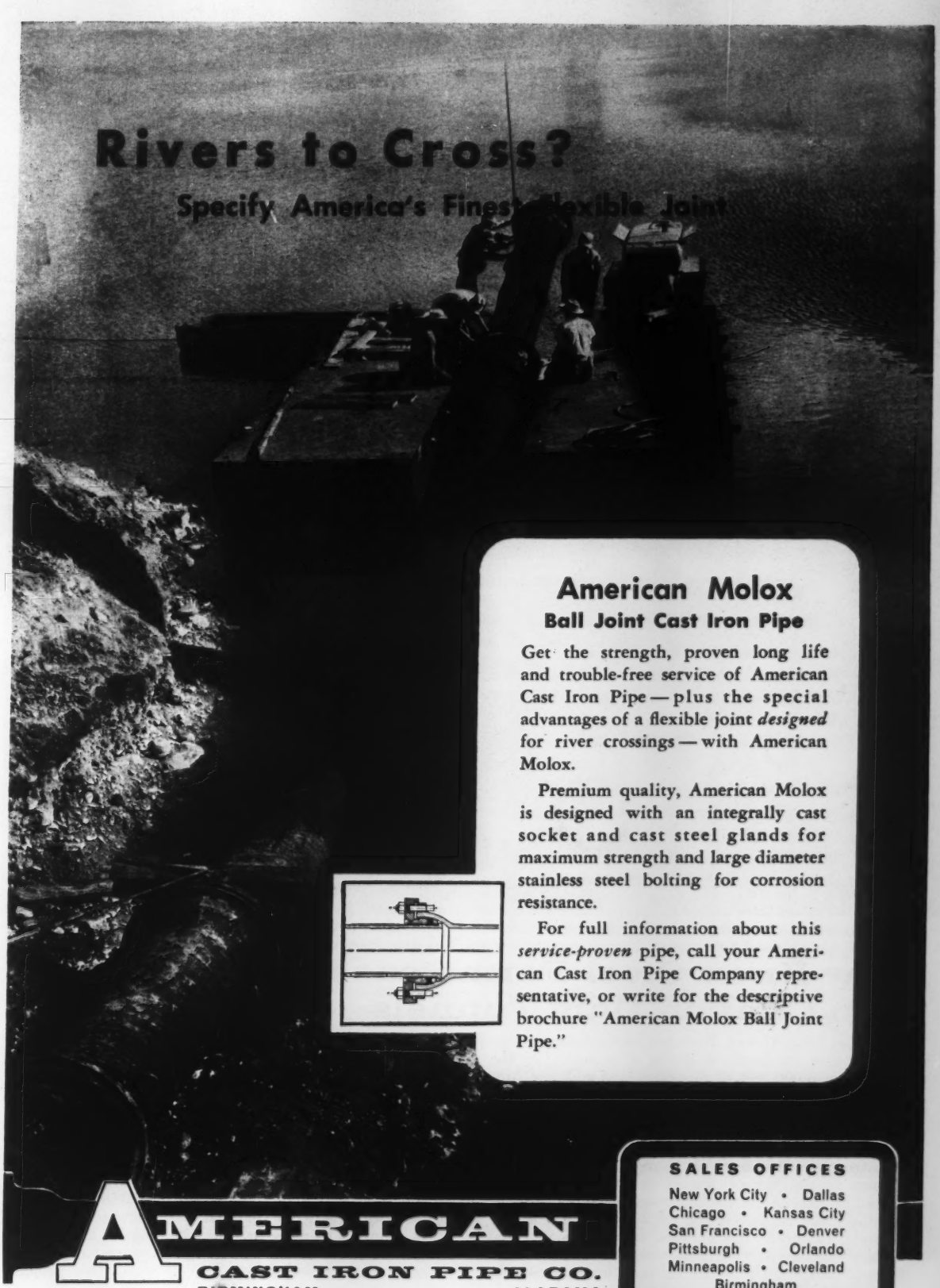
Of course Mr. D is our hero in this story, but labor rules vary from time to time and place to place. The moral is that an examination question should be read three times—first *suspiciously* to see if you have the experience to answer it, second *objectively* to find exactly what is given and what is wanted, and third *critically* to appraise what is left unsaid, and why. Be specific when you supply missing data. Mr. C's answer is excellent if he definitely presumes that the hauling contractor has a truck park for his fleet close to the siding.

EXAMGEM No. 3—the Silted Dam

A simple problem may be difficult if we look too hard for a catch that isn't there. If that is a hint, it's too late for those who met the following problem on an Ohio examination last February:

Immediately after construction, the normal depth of water behind a dam was 40 ft. Sediment consisting of cohesionless silt has been deposited subsequently to a depth of 25 ft. Compare the original purely hydrostatic pressure on the dam with the probable value of pressure resulting from the present conditions. Illustrate your conclusions by means of a sketch showing the variation of pressure intensity and pertinent numerical values thereof. Assume the following properties for the sediment:

Void ratio, (volume of voids/volume of solids) = 0.80.
Specific gravity of solid constituents = 2.65
Angle of internal friction = 0°



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60-foot long Blaw-Knox tunnel form in position inside east diversion tunnel at Glen Canyon Dam. Each linear foot of the 33-inch tunnel wall required 20 cubic yards of concrete. Blaw-Knox Forms consistently met accuracy requirements.

Blaw-Knox Steel Forms ease concreting of Glen Canyon Dam Tunnels

Two 60-foot long, 41-foot diameter, non-telescopic tunnel forms met required standards of accuracy in the concreting of 6,000 feet of diversion and spillway tunnels at Glen Canyon Dam on the Colorado River. Their special design permitted the lining of curved or tangent sections within radii as small as 165 feet.

A total of 140,000 cubic yards of concrete was used in constructing 33-inch thick tunnel walls. Preassembled outside the tunnel, the Blaw-Knox Forms were mounted on rails. After the form was placed, a series of hydraulic jacks expanded the unit to match the "A" line grade. Concrete was pumped into place, vibrated to eliminate honeycombing, and cured for 16 to 24 hours.

Merritt-Chapman & Scott Corporation, prime contractor for Glen Canyon Dam, employed a 20-man crew to set, strip, and reset the form. A specially designed Blaw-Knox screed was used to pave inverts of both tunnels. This method, combined with the accuracy of the Blaw-Knox Forms, pour after pour, helped to considerably reduce time and costs.

Blaw-Knox Steel Forms Consultation Service is available to contractors on all types of concreting. For more than forty years, Blaw-Knox Forms Engineers have made their experience available to enable contractors to save time and cut costs on dams, bridges, and tunnels. Contact us early in your planning for a profitable engineering contribution, or you may wish to write for a copy of technical report 2571 covering this project.

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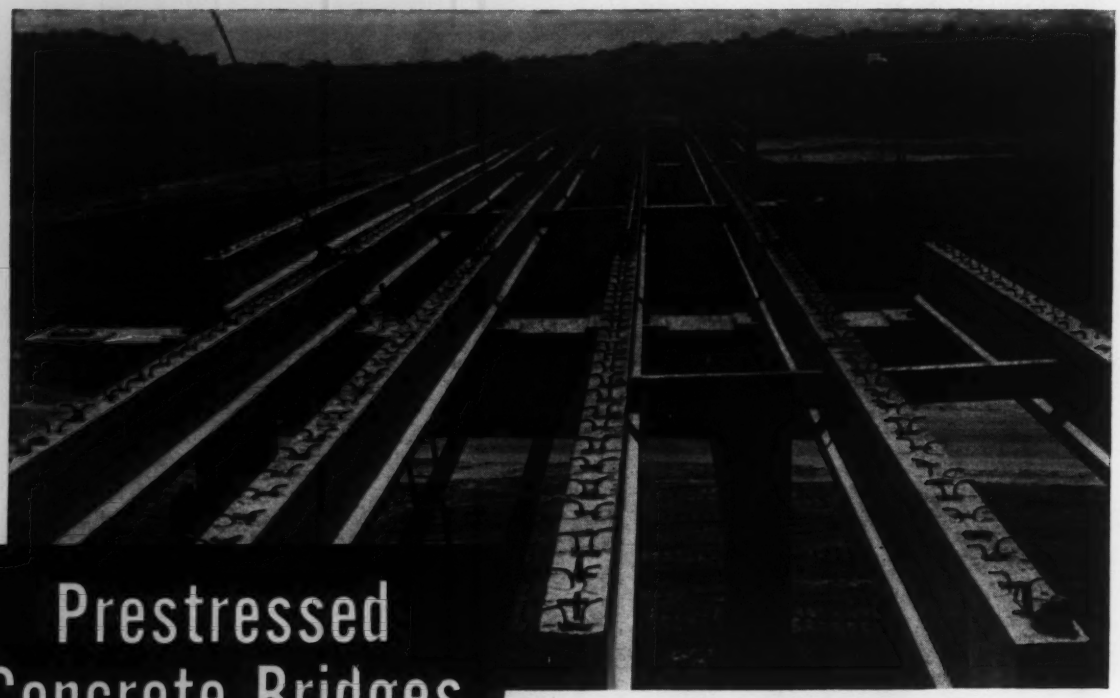
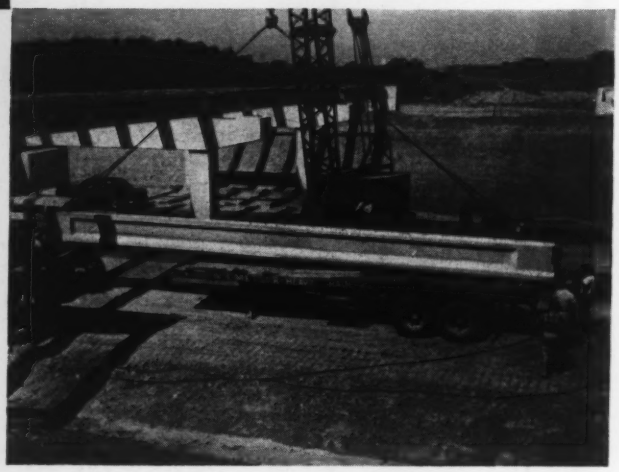


Prestressed Concrete Bridges

ON INTERSTATE ROUTE 40

Twin structures for U.S. Route 45 cloverleaf on Interstate Route 40, just north of Jackson, Tennessee.

A 51′ beam ready to be moved from truck to piers. Traffic under bridge continues without interruption.



As the construction tempo of the new Interstate Highway System increases, more and more of its structures are being designed for prestressed concrete beams. Low first cost, negligible maintenance, speed of erection, and attractive appearance are the reasons for this growing preference for prestressed concrete.

An example is the new Interstate Route 40 by-pass of Jackson, Tenn. Eight of the nine bridges on this job will have prestressed beams. A total of 264 beams will be used, ranging in length from 35′9″ to 92′3″, with the largest members weighing 47 tons each.

In the manufacture of these beams, R. H. Wright, Inc. used Lehigh Early Strength Cement for maximum production efficiency. Units were completed quickly, ready for trucking to the job site as needed.

This is another example of the advantages of Lehigh Early Strength Cement in modern concrete construction.

Owner: Tennessee Highway Dept.

Contractor: Oman Construction Co. Nashville, Tennessee

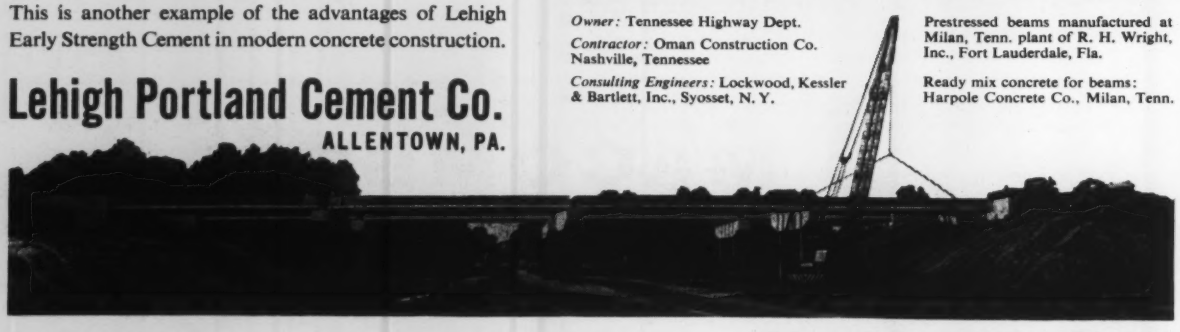
Consulting Engineers: Lockwood, Kessler & Bartlett, Inc., Syosset, N. Y.

Prestressed beams manufactured at Milan, Tenn. plant of R. H. Wright, Inc., Fort Lauderdale, Fla.

Ready mix concrete for beams: Harpole Concrete Co., Milan, Tenn.

Lehigh Portland Cement Co.

ALLENTOWN, PA.



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SECONDS
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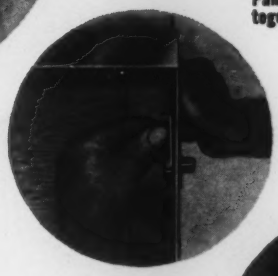
UNI-FORM TIE
AND ASSEMBLE PANELS

1. UNI-FORM Tie Loop placed in square tie hole of Panel.



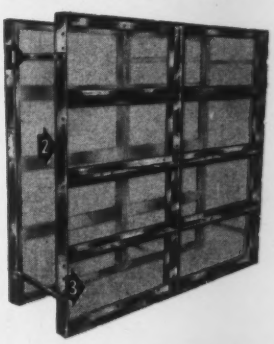
2. Tie Key set into the Tie Loop. Panel and Tie are now locked together into integral unit.

3. Next UNI-FORM Panel is placed in position. Tie Loop automatically enters square tie hole. Key is dropped in—assembly is complete. NO COMING BACK TO "FISH" TIES.

When you can tie and lock two concrete form panels in a few seconds, you're forming concrete fast! This is exactly what you can do with the UNI-FORM Panel System—the fastest system of forming concrete ever developed.

Faster tieing is only one of many UNI-FORM Panel features that makes them *the* pre-fab forms contractors are using on every kind of concrete construction. Write for the UNI-FORM Panel System Catalog and full details . . . or, call your nearby Universal Distributor or Branch Office for personal attention immediately.

UNI-FORM PANELS ERECT INTO A TIGHT, RIGID, AUTOMATICALLY ACCURATE CONCRETE FORM



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3. Best Exterior Grade Plywood face provides nailing surface. Easily turned for further reuses.

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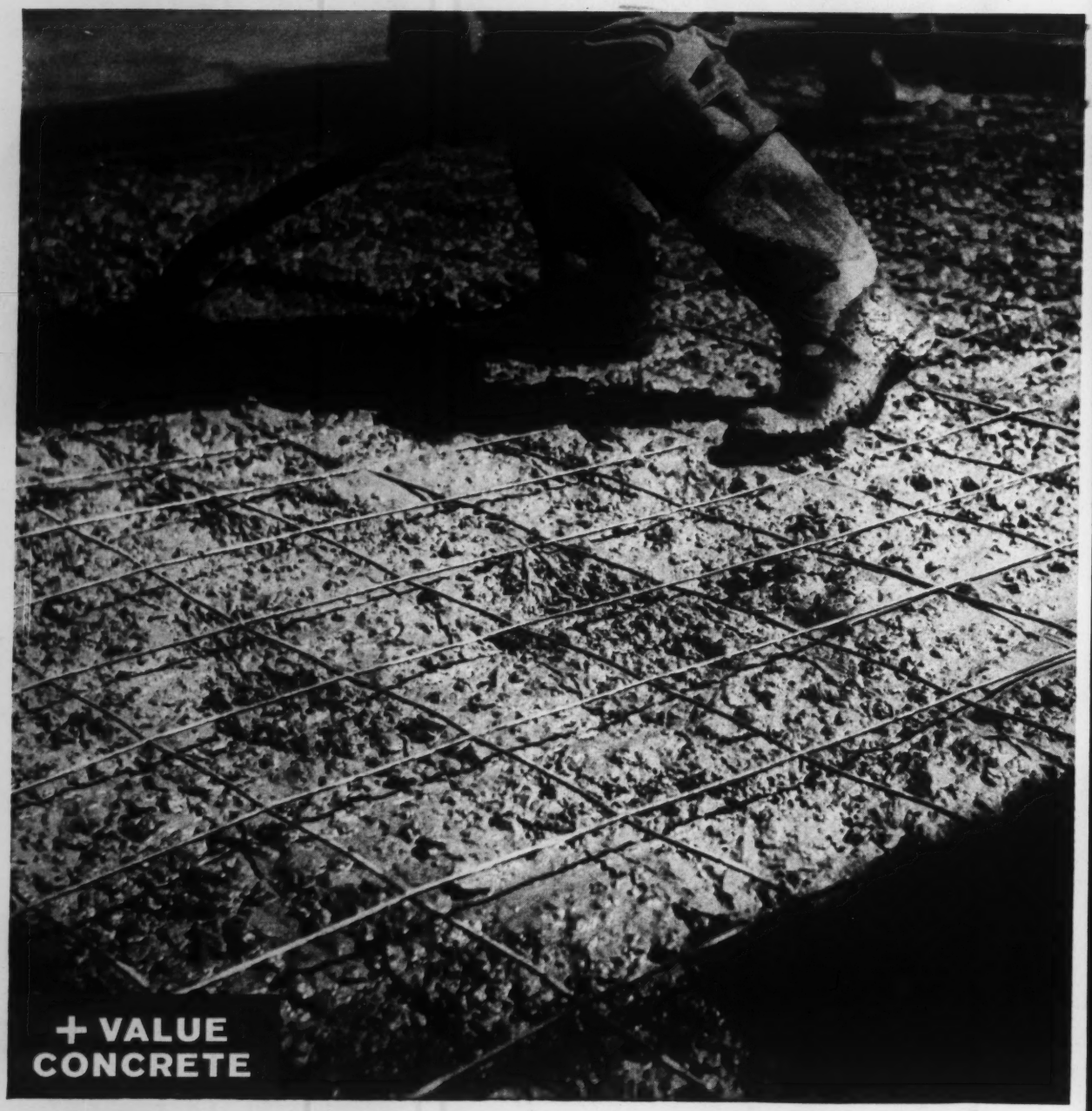
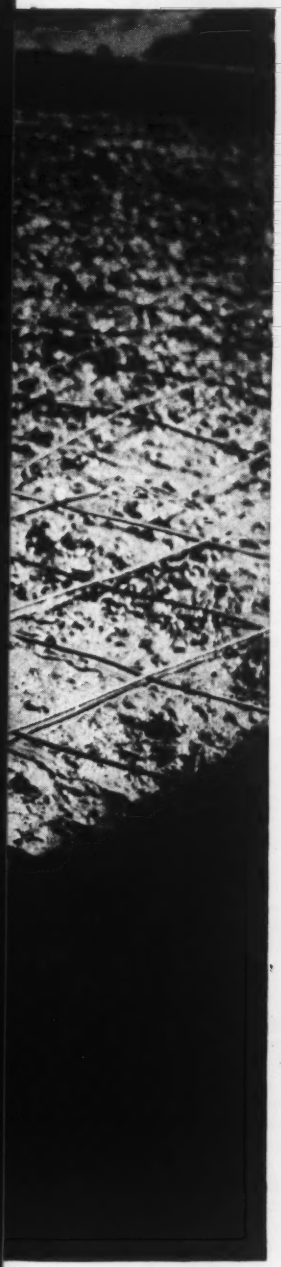
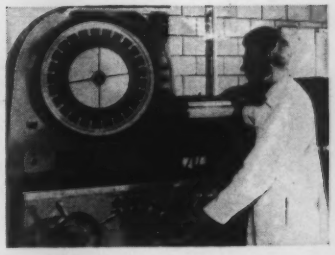


Wire Fabric has minimum tensile minimum yield point of 60,000 psi...



to give you a better, stronger product at no increase in cost!



For more than 50 years, USS American Welded Wire Fabric has been doing an outstanding job of reinforcing all kinds of concrete work—from porches and walks to skyscrapers and highways. And now—because of its greatly increased tensile and yield strength—it will give even greater strength, longer life, increased freedom from cracking and less maintenance. Also, it will permit longer joint spacing for reinforced slabs on ground or less steel if present joint spacing is used. The new improved Welded Wire fabric will have a 75,000 psi minimum ultimate tensile strength with a minimum yield point of 60,000 psi.

Closely controlled laboratory tests show that if the conventional bond stress theory is applied to American Welded Wire Fabric's resistance to slip, fantastically high bond stress values of from 1,000 psi to 2,700 psi are computed. (See ACI Proceedings, Vol. 48, April, 1952.) Continuing bond test research under the direction of American Iron & Steel Institute has shown such good mechanical anchorage in the concrete as to permit this increase in the Tensile Strength of Fabric. American Steel & Wire is able to present this new product because of the tested bond values which enable designers to take advantage of a higher fabric yield point.

Just one example of the advantages of this improved fabric is in one-way slabs. The ACI Building Code 318-56 will allow unit tensile strength for fabric in main reinforcement of 30,000 psi in one-way slabs of 12-foot span or less, provided reinforcing members are $\frac{3}{8}$" or less. Previously, designers were limited to 28,000 psi working stress with fabric, and only 20,000 psi with intermediate grade bars.

The new Welded Wire Fabric will cost no more. It will come in the same prefabricated rolls or sheets for easy handling and placing. Therefore, to get the improved product on your job at no extra cost, be sure to specify USS American Welded Wire Fabric.

USS American Welded Wire Fabric is available in a wide variety of styles, sizes, lengths and widths . . . in wire gauges from $\frac{1}{2}$" diameter to 16 ga., and in longitudinal and transverse wire intervals of 2" to 16". Steel areas for all normal structural reinforcing in all types of construction are readily available. For more information on USS American Welded Wire Fabric—and its new tensile strength—write to American Steel & Wire, Dept. 9260, 614 Superior Avenue, N. W., Cleveland 13, Ohio.

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American Steel & Wire Division of United States Steel

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Always ask, "is it Reinforced"

DECEASED

Frank J. Cheek, Jr., (M. '45), age 66, professor of hydraulic and sanitary engineering at the University of Kentucky, Lexington, Ky., died there recently. Professor Cheek taught at Kansas State College for over thirteen years, leaving in 1937 to act as a consultant on the engineering curricula at Central University in Venezuela. Upon the completion of this assignment he joined the engineering staff of the University of Kentucky as a professor. Professor Cheek received his A.B. from Centre College in 1914, a civil engineering degree from Rensselaer Polytechnic Institute in 1919, and an S.M. from Massachusetts Institute of Technology in 1933.

Henry Lehrbach (M. '48; F. '59), retired civil engineer of Rochester, N. Y., died there on June 29. Mr. Lehrbach retired in 1958 as office manager for the Eastman Kodak Company after twenty-four years with the organization. He was graduated from Cornell University in 1915 and during World War I, served in the Navy, retiring with the rank of lieutenant commander.

Ferdinand T. Loehninger (M. '35), age 70, president of Ferdinand T. Loehninger, New York City consulting engineering firm, died there recently. In 1932 Mr. Loehninger founded the firm bearing his name, which developed from the earlier partnership of Fish and Loehninger. The firm specialized in structural and foundation design. Mr. Loehninger's early experience was as design engineer for Charles Mayer and as inspector of streets for Dayton, Ohio. He was a graduate of Rose Polytechnic Institute, class of 1913.

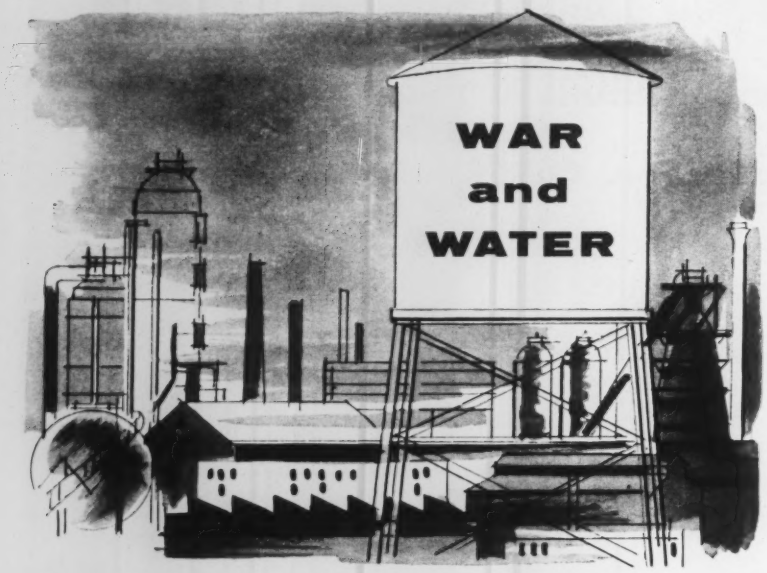
Robert L. Lowry, Jr., (M. '40), age 59, consulting engineer of Austin, Tex., died there recently. Widely known as a water engineer, Mr. Lowry had worked in several foreign countries, including Pakistan and Venezuela. He also aided in the development of the Colorado River. Mr. Lowry was a graduate of Trinity University and the University of Texas. Long active in the Texas Section, he had served it as president.

Phillip D. More (A.M. '58) age 37, structural design engineer with Black & Veatch, Kansas City, Mo., died there recently. A 1947 civil engineering graduate of Colorado Agricultural and Mechanical College, Mr. More had wide experience in steam power plant construction. He had been in charge of the structural design of several plants for the Kansas Power and Light Company at Topeka; of plants for the Florida Power Corporation at Ellaville, Enterprise, and St. Petersburg, Fla.; and of plants for the cities of Denton and Garland, Tex. In his earlier career Mr. More was resident engineer on construction of a water treatment plant for Princeton, Ky., and in charge of a sewer survey for the city of Denver, Colo.

J. P. Mutchler (M. '59; F. '59), age 58, construction chief for the Potomac River Naval Command, died in Kensington, Md., on July 5. Mr. Mutchler had been manager of the construction and inspection division of the command's public works office for the past ten years. Previously he was resident engineer in charge of construction at the Naval Ordnance Laboratory in White Oaks, Md. where he supervised part of the building of the facility, including the wind tunnel. Shortly after receiving his civil engineering degree from Cornell University in 1922, Mr. Mutchler joined the bridge department of the Bureau of Public Roads, for which he supervised the construction of a number of bridges.

Lawrence K. Needham (A.M. '12), age 76, resident engineer for the Spokane, Portland & Seattle Railway System, Portland, Ore., died in that city recently. A 1907 civil engineering graduate of the University of Nebraska, Mr. Needham devoted his entire career to railroad work. He became connected with the Spokane, Portland & Seattle Railway in 1920. Before that he had been with the Panama Railroad in Panama, rising from

(Continued on page 112)



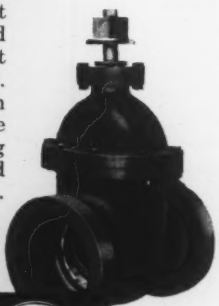
Domestic uses amount to only about 3% of U. S. annual water consumption.

During "cold" war maneuvers and real war rumors, it is well to remember that industrial water is a basic resource in national preparedness and in war. Entirely apart from human needs, without industrial water supply there could be little or no production of war materials.

Industrial production requires over 5 billion gallons of water daily. Inadequate water supply could cripple or kill industrial operations as they can knock out a man. The basic materials used to make aircraft may be metals, but the metals themselves could not be produced without the use of water. It takes 150 tons of water to make 1 ton of steel.

When you see a military airplane soar through the air, or read of the latest missile shot to the moon—remember that behind the scenes, unsung and perhaps unknown, were the engineers and management of a modern water works system.

This Series is an attempt to put into words some appreciation of the water works men of the United States.



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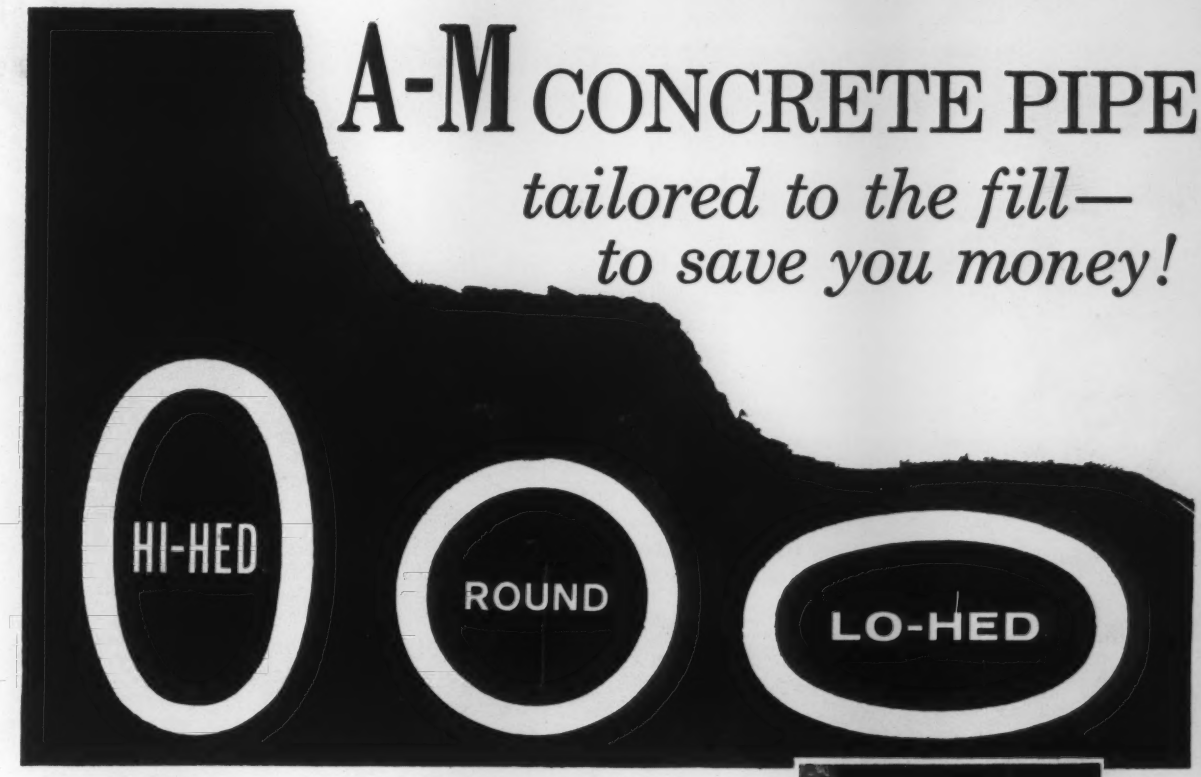

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FOR AVERAGE FILLS, round concrete pipe is the *most economical* permanent conduit and American-Marietta saves added dollars through nationwide technical and manufacturing services.

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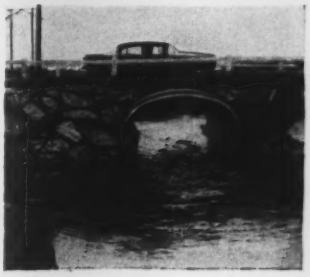

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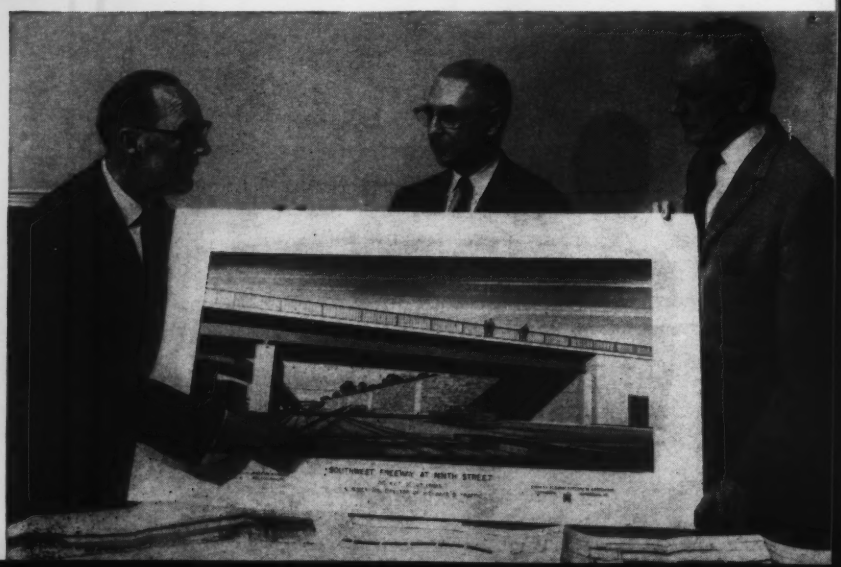
Steel bridge carrying US Route 22 over Bushkill Creek in the vicinity of Easton, Penna.



John R. Dietz, Vice President, Earl D. Schwartz, Chief of Bridge Section, and W. H. Corddry, President, discussing an artist's rendering of a steel bridge over the Southwest Freeway in the District of Columbia.

Steel enjoys wide use in short-span bridge design

at Gannett, Fleming, Corddry & Carpenter, Inc., Consulting Engineers, Harrisburg, Penna.

This firm has designed short-span steel bridges for many important highways. These include the Pennsylvania, New Jersey and West Virginia Turnpikes; the Connecticut Expressway; Garden State Parkway; Penn-Lincoln Parkway, Pittsburgh; Schuylkill Expressway, Philadelphia; and Southwest Freeway, Washington, D. C.

Normally, 70% of their short-span bridges are designed in steel. There are many good reasons for this, according to Mr. John R. Dietz, Vice President in charge of the highway and bridge division of the firm.

Steel is a familiar material. There is a tremendous library of knowledge accumulated on steel and there are no unknown factors. This is important because the designer is looking for reliable performance.

Steel goes up in a hurry. Short spans must be constructed with least interference with traffic. The rapidity with which steel can be erected is a big advantage.

Steel permits maximum headroom. Also minimum approach alteration, less dislocation of existing buildings and roads and lower costs.

Steel reduces costs. Lighter construction with steel reduces foundation costs and faster erection saves labor. New high-strength steels offer greater strength with less bulk.

Steel production facilities have increased. The steel industry has greatly expanded its facilities for manufacture of structural shapes and plates.

You can confidently design in steel—the material you know best, and the material that offers you the most.

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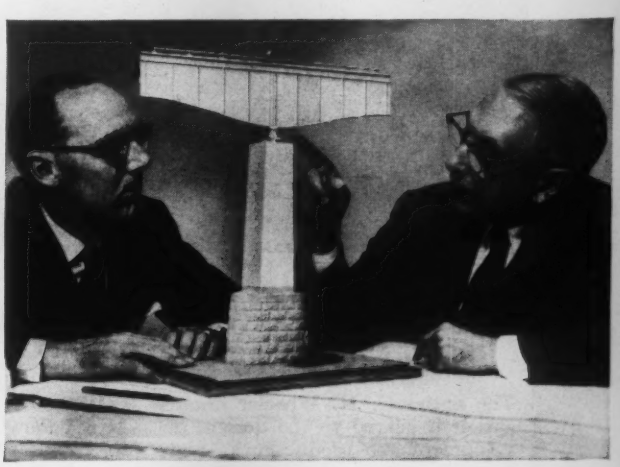
United States Steel

Steel bridge carrying Route 22 over Route 309 near Allentown, Penna. Steel is versatile and available. It can be readily welded, flame-cut, riveted, bolted.



Mr. Dietz (left) and Mr. Schwartz discussing a model of a welded steel girder on an elevated pier.

Deceased

(Continued from page 108)

the job of levelman to the position of assistant engineer on construction.

Leonard D. Norsworthy (M. '28; F. '59), age 80, died in Washington, D.C., on July 1. He had retired as principal engineer in the Office of the Chief of Engineers, Department of the Army, in 1948, following thirty-six years of Federal service, twenty-nine of them with the Corps of Engineers. Starting as a hull designer for the Board of Engineers for Rivers and Harbors, Mr. Norsworthy rose to the position of assistant chief of the Engineering Division for Civil Works. As a specialist on the effect of hydroelectric projects and related facilities on river and harbor and flood control conditions, he served in a liaison capacity with the Federal Power Commission. Mr. Norsworthy attended Columbia University, receiving the civil engineering degree in 1909 and the M.A. in 1910.

William H. Penfield (M. '05), age 85, retired chief engineer of the Milwaukee Railroad, died recently in Savanna, Ill. Mr. Penfield joined the Milwaukee Railroad in 1899 and retired in 1945, after forty-six years with the line. He served as construction engineer for thirty years and as chief engineer for ten years.

Patrick E. Preston (J.M. '58), age 23, of Pensacola, Fla., died recently. After graduating from Vanderbilt University with an engineering degree in 1958, he joined the U. S. Navy as an Ensign at the Pensacola (Fla.) Naval Air Station, where he received his flight training.

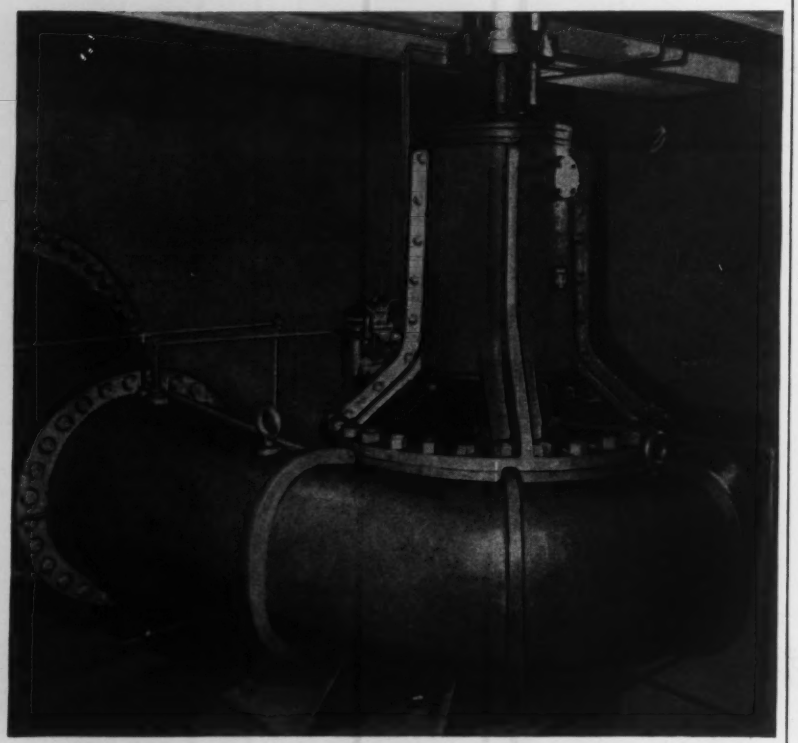
Elwin G. Speyer (M. '18; F. '59), age 74, former Buffalo commissioner of public works and chief engineer of the Buffalo Grade Crossings and Terminal Station Commission, died in Buffalo, N. Y., on July 18. A 1906 graduate of Cornell University, Mr. Speyer's first position was as a designer for the American Bridge Company at Ambridge, Pa. From 1920 until 1945, when he was named public works commissioner, Mr. Speyer was engaged in private practice. He had been consultant to the New York State Port Authority, the Buffalo Planning Board, the Buffalo Police Department on traffic and safety matters, and the Joint Legislative Vehicular Traffic Control Commission. He retired as commissioner in 1950.

Howard John Squires (M. '49), age 53, since 1951 chief hydraulic engineer with the Ministry of Works in Nairobi, Kenya, died in London recently. A British subject, Mr. Squires was an honor graduate of the City and Guilds (Engineering) College of the University of London in 1927 and did postgraduate work in hydroelectricity there in 1928. He then entered the Indian Service of Engineers as an assistant executive engineer to the Irrigation Department of Burma, remaining there through the Burma Campaign of World War II. Prior to joining the Kenya Ministry of Works Mr. Squires served as senior assistant with Messrs. Binnie, Deacon and Gourley on dam design.

Harold L. Stevens (M. '16), age 83, president of H. L. Stevens and Company, Chicago, Ill., died in Chicago recently. Mr. Stevens graduated from the University of Wisconsin in 1903 with a degree in civil engineering. In the same year he became provincial engineer for the Philippine Islands, engaged on road, bridge and building work. After that he was briefly design engineer and chief engineer for the Oliver Company of Knoxville, Tenn. In 1909 he founded and became president of H. L. Stevens and Company and H. L. Stevens, Inc., specialists in the design and construction of hotels throughout the United States and Canada.

Albert H. Swift (M. '56; F. '59), age 56, assistant Chicago district engineer for the American Bridge Division of the United States Steel Corporation, died on July 8 in Hinsdale, Ill. He was a graduate of Purdue University. In 1927 he joined the New York staff of the American Bridge Division, transferring to the Chicago district office in 1946.

(Continued on page 114)



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The entire C. H. Wheeler organization is geared to the design, development and production of high-capacity pumps.

Pumps like the one you see here, for example—one of three 36″ x 30″ Vertical Mixed Flow Volute Units installed at the Wapato Irrigation Project, State of Washington. These Pumps handle larger volumes at lower first cost than any other kind of pumping equipment!

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and Civil Engineering Show

at Hotel Statler-Hilton, Washington, D.C.

October 19-23, 1959

- Technical and professional sessions and discussions
- Third ASCE-sponsored commercial civil engineering exhibit
- Demonstrations of equipment, materials, tools, methods
- Inspection trips to major engineering projects in the area
- Informal get-together—meet old friends, make new contacts

AMERICAN SOCIETY OF CIVIL ENGINEERS

1959 CIVIL ENGINEERING SHOW

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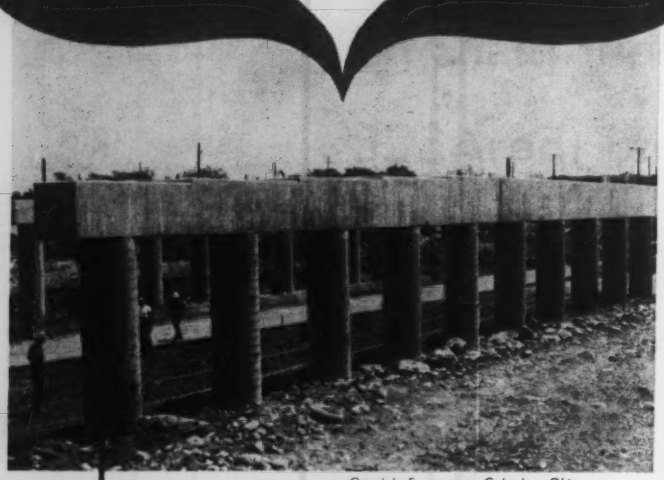

Goodale Expressway, Columbus, Ohio
Engineer: Aldon E. Stelson & Associates
Contractor: Baker & Hickey Construction Company

Reduce finishing time with SONOCO Seamless Sonotube® FIBRE FORMS

Round concrete columns formed with Seamless SONOTUBE Fibre Forms have a smoother continuous concrete surface . . . only a minimum of finishing is required.

Use Seamless SONOTUBE Fibre Forms wherever finished, exposed columns are required. They form better, strip smoother, finish easier . . . save contractors time, labor and money.

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Besides Seamless, there are these other types of SONOTUBE Fibre Forms to choose from: "A" Coated (standard form for exposed columns); "W" Coated (for unexposed columns); and Encasement Forms (for encasing existing pillars, posts, piles, etc. with concrete).

All Sonoco SONOTUBE Fibre Forms are available in sizes 2″ to 48″ I.D., in specified lengths or standard 18′ shipping lengths. Can be sawed.

Seamless SONOTUBE Fibre Forms, 36″ I.D., used on this job. (Forms not stripped in this photo.)

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4086

Deceased

(*Continued from page 112*)

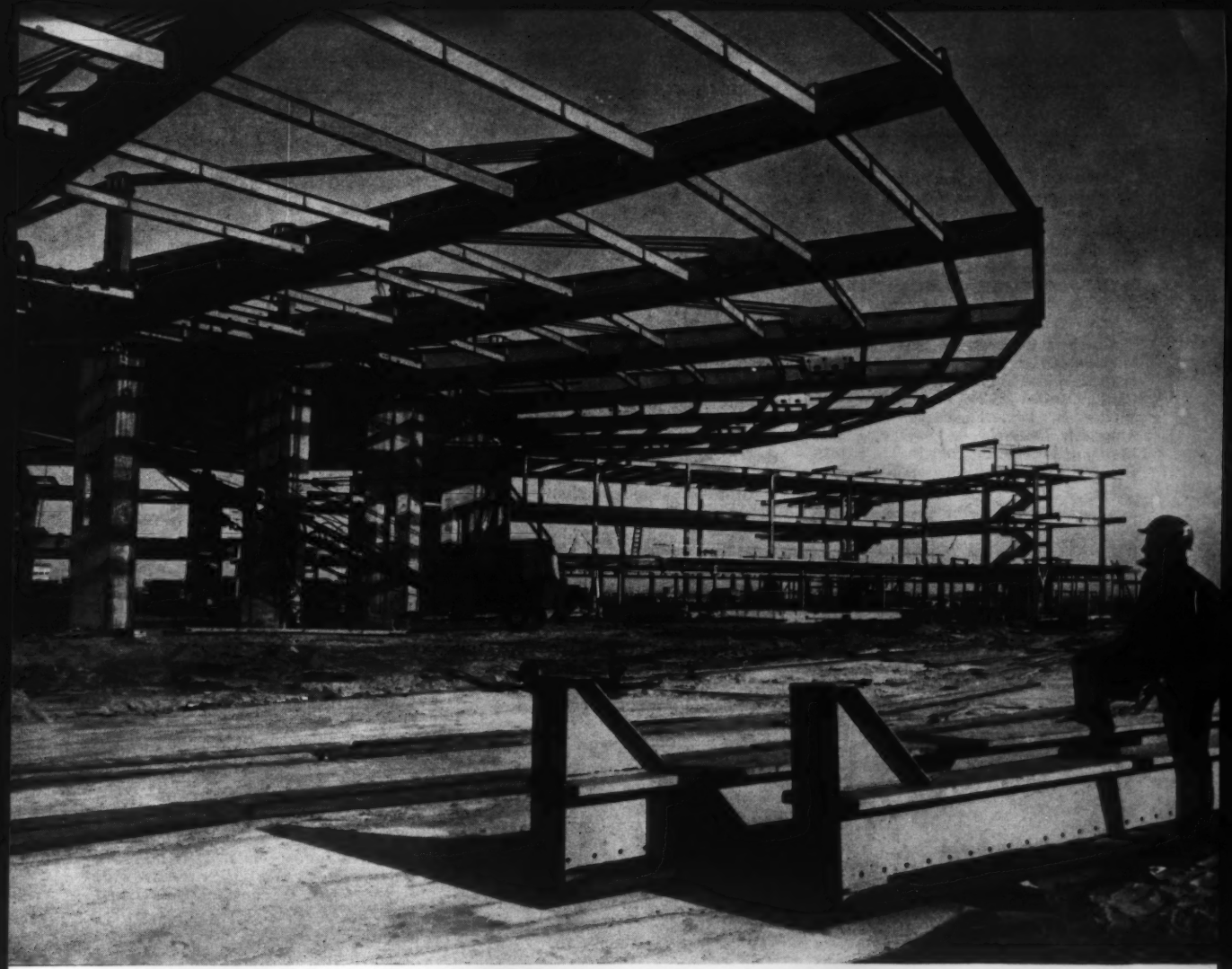
C. Eugene Tovell (A.M. '36; M. '59) age 56, for the past ten years civil engineer with the Long Corporation, of Atlanta, Ga., died in Atlanta recently. A graduate of Johns Hopkins University, Mr. Tovell for many years headed the Tovell Construction Company, at Greenville, Ga.

Frank S. Whitney (M. '53; F. '59), age 65, public works director of Huntington, W. Va., died there on July 6. Mr. Whitney was first employed by the city of Huntington in 1941 as city engineer. He was named public works director after the form of government was changed to council-manager in 1957. In municipal service he had charge of numerous important projects, among them the city's $11,000,000 sewage treatment system, the sewer modernization program, and the selection of the site for the Tri-State Airport. For three years he was manager (the first) of the airport, returning in 1955 to the post of city engineer. Mr. Whitney received his civil engineering education at Iowa State College.

Waldo G. Wildes (M. '12; F. '59), age 80, retired civil engineer of Rochester, N. Y., died there on June 27. A career employee of the New York State Engineer Department at Rochester from 1903 to 1924, Mr. Wildes by 1924 had attained the rank of resident engineer senior grade. During his tenure with the department he had charge of the Delta Reservoir Project, 1910-1912, including the Mohawk River locks and movable dams. He was also resident engineer on barge canal construction on the western division. In 1924, Mr. Wildes left to go into private practice in Rochester, which he maintained until his retirement in 1945. He was a civil engineering graduate of the Massachusetts Institute of Technology.

Alfred Daniel Wolff, Jr., (A.M. '16), age 75, retired assistant vice president of the New York Central Railroad System, died recently in Cleveland, Ohio. A University of Pennsylvania graduate with a major in economics and civil engineering, Mr. Wolff, started his lifetime association with New York Central in 1910. From 1926 to 1942 he was engaged on the initial surveys and baseline work involved in removing tracks from the west side of New York City and the related city express highway project and extension of Riverside Park. He served as assistant vice president from 1950 until his retirement in 1954.

[*Correction:* In the June issue it was erroneously reported that Wilbur W. Davis, M.'17, was retired chief engineer of the Metropolitan (Boston) Transit Authority at the time of his death on April 15, 1959. At the time of his retirement in 1947, Mr. Davis was chief engineer of the Boston Transit Department which was not taken over by the Metropolitan Transit Authority until 1949.]



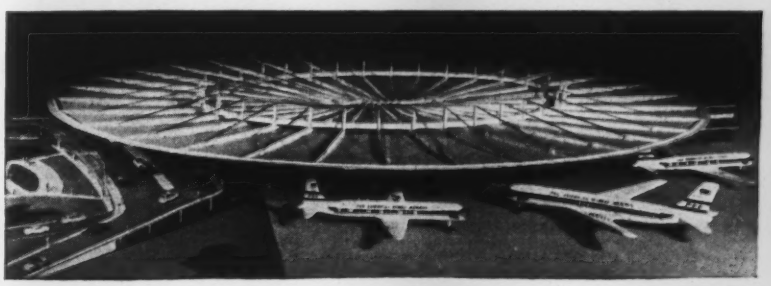
Steel umbrella large enough to cover Yankee Stadium

"The House that Ruth Built" could tear up its rain-checks if covered by a steel umbrella of this size. Instead of shielding the bleachers, however, this umbrella will protect Pan American jet passengers from the weather at New York International Airport.

With 4,000 tons of Bethlehem structural steel in its rugged framework, this $8 million, elliptical-shaped structure incorporates elements of suspension bridge design. The cantilever-supported canopy, to flow upward over the glass-enclosed building, will project 114 ft beyond the roof-supporting columns.

The canopy is suspended by thousands of feet of Bethlehem wire rope. Hundreds of tons of Bethlehem steel reinforcing bars are also being used in this modern terminal building.

Whether you're building dams or churches, highway bridges or shopping centers . . . our nearest sales office stands ready to give you full details on the many forms of Bethlehem steel for construction. Give us a call today. Or write us at Bethlehem, Pa.



Scale model of Pan American World Airways' new jet terminal at New York's International Airport. *Architects and Engineers:* Tippetts-Abbett-McCarthy-Stratton; *Associate Architects:* Ives, Turano and Gardner; *Fabricator:* Lehigh Structural Steel Co.; *Erector:* Lehigh Construction Co.; *General Contractor:* Turner Construction Co. Structural steel supplied by Bethlehem Steel.

BETHLEHEM STEEL

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Non—ASCE Meetings

American Concrete Institute. Twelve regional meetings at the Continental Hilton Hotel and the Hotel Del Prado, Mexico City, Mexico, November 3-5. For advance information write to Charles L. Cousins, American Concrete Institute, P. O. Box 4754, Redford Station, Detroit 19, Mich.

American Congress on Surveying and Mapping. Western Regional Conference at the Statler-Hilton Hotel, Los Angeles, Calif., October 28-31. For details write Walter S. Dix, Executive Secretary, American Congress on Surveying and Mapping, 905 Washington Building, 1435 G Street, N. W., Washington 5, D. C.

American Institute of Chemical Engineers. Forty-first national meeting at the Hotel St. Paul, St. Paul, Minn., September 27-30. Address queries to Raymond C. Mayer & Associates, 51 East 42nd Street, New York 17, N. Y.

American Institute of Electrical Engineers. Fall general meeting at the Hotel Morrison, Chicago, Ill., October 11-16. Information concerning hotel facilities and program available from Raymond C. Mayer & Associates, 51 East 42nd Street, New York 17, N. Y.

American Institute of Mining, Metallurgical and Petroleum Engineers. Joint Solid Fuels Conference with the American Society of Mechanical Engineers at the Netherland-Hilton Hotel, Cincinnati, Ohio, October 27-29. Advance information from Julian E. Tobey, General Chairman of the Conference, American Institute of Mining, Metallurgical and Petroleum Engineers, 29 West 39th Street, New York 18, N. Y.

American Public Health Association. Annual meeting at Convention Hall, Atlantic City, N. J., October 19-23. Address requests for information to the American Public Health Association, 1790 Broadway, New York 19, N. Y.

American Public Works Association. Annual congress and equipment show at the Seattle Civic Auditorium, Seattle, Wash., September 20-23. Information from the American Public Works Association, 1313 East 60th Street, Chicago 37, Ill.

American Society of Mechanical Engineers—American Institute of Electrical Engineers. Seventh Engineering Management Conference at the Statler-Hilton Hotel, Los Angeles, Calif., September 17-18.

National Power Conference at the Muehlebach Hotel, Kansas City, Mo., September 28-October 1.

Information about the conferences, hotels and advance registration available from L. S. Dennegar, the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y.

American Society for Testing Materials. Third Pacific Area National Meeting and Apparatus Exhibit at the Sheraton-Palace Hotel, San Francisco, Calif., October 11-16. For details write to the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

American Standards Association. National conference on standards at the Sheraton-Cadillac Hotel, Detroit, Mich., October 20-22. For further details write to the American Standards Association, 70 East 45th Street, New York 17, N. Y.

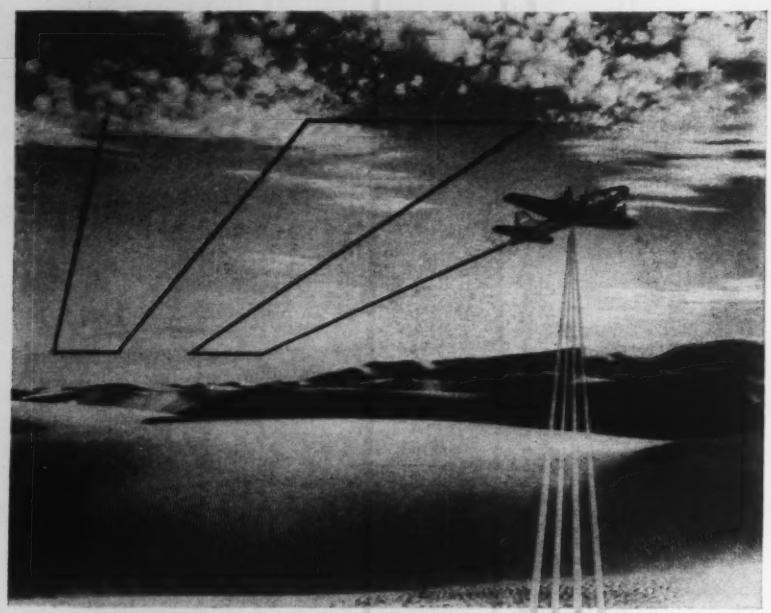
American Welding Society. National fall meeting at the Sheraton-Cadillac Hotel, Detroit, Mich., September 28-October 1. Additional information may be had from the American Welding Society, 33 West 39th Street, New York 18, N. Y.

Building Research Institute. Fall conference at the Shoreham Hotel, Washington, D. C., November 16-19. For further details write to the Building Research Institute, National Academy of Sciences, 2101 Constitution Avenue, Washington 25, D. C.

Federation of Sewage & Industrial Wastes Associations. Meeting at the Statler Hilton Hotel, Dallas, Tex., October 12-15. Address queries to the Federation of Sewage & Industrial Wastes Associations, 4435 Wisconsin Avenue, N.W., Washington, D. C.

Instrument Society of America. Fourteenth Annual Instrument-Automation Conference and Exhibit in Chicago, Ill., September 21-25. The exhibit will be in the International Amphitheatre while the conference sessions will be held in the Palmer House and Hotel Morrison. Re-

(*Continued on page 124*)



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The RADAN 500 Doppler radar automatically and continuously determines ground speed and drift angle of the aircraft. From this information an electronic "brain" in the aircraft computes its exact position, enabling the pilot to fly precise flight paths over desert, jungle, ice or any featureless terrain without ground control of any kind.

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Some Ideas

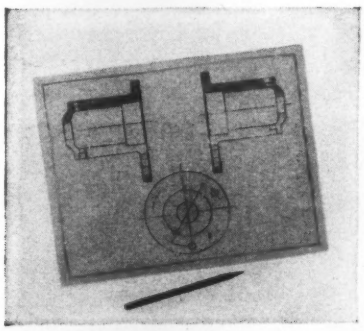
for your file of practical information on drafting and reproduction from

KEUFFEL & ESSER CO.

A year of relentless testing has produced a small library of interesting facts about HERCULENE (T.M.) Drafting Film. What follows is a consensus of drafting-room experience with HERCULENE—by K&E and its customers—with some up-to-date recommendations for using it. Take the matter of . . .

Shiny Back vs. Pencil Back

A basic question is: do you need a double-surfaced drafting film? We make HERCULENE Drafting Film both ways, of course—with a single surface (shiny back) and double surface (pencil back). It's our recommendation that you use pencil back HERCULENE only if it's your practice to make basic drawings on one side, changes on the other. For most other uses, shiny back is preferable. (At first, the double-surface film was chosen by many drafting rooms because it lay flatter on the board than shiny back. This is no longer true. K&E research labs have come up with a fully effective anti-curl treatment.) Especially in filing, shiny back HERCULENE presents fewer problems. The clean non-abrasive back won't smudge the face of the sheet underneath, even in a heavy stack of tracings. If you'd like to compare a few sheets, please let us know.



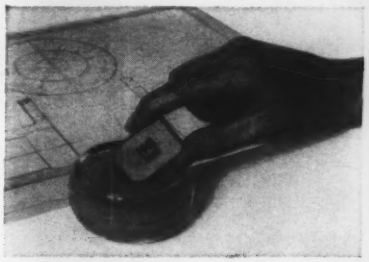
Note sharp clear lines made by Duralar pencil on HERCULENE Drafting Film.

Plastic Pencils and the HERCULENE Surface

Not just a handy catch-phrase, when K&E puts its exclusive "engineered surface" on a drafting material, the result is an exact, uniform tooth for sharp pencil drawing, inking and typing. With HERCULENE Drafting Film, however, an entirely new type of plastic (non-graphite) pencil yields especially good results. Quite a few of our customers have reported favorably on the well-known Staedtler "Duralar" brand. Duralar pencils come in five hardnesses, are non-smudging and have generally good covering power, sharpness and erasability. After about 20 prints, the Duralar lines show up consistently better than those made by a regular pencil, since graphite lines tend to lose density.

Wet That Eraser!

The erasing qualities of HERCULENE Drafting Film are excellent, but (as with the pencils) we've discovered it's a new type of vinyl eraser that gives the best results. Examples of these non-rubber type erasers are the Richard Best "TAD" and the Eberhard Faber "RACE KLEEN"—both available from your K&E dealer. With vinyl erasers, pencil lines whisk off. Even stubborn ink and typing can be removed easily, with no damage to the surface. Here's a tip on how to do this:

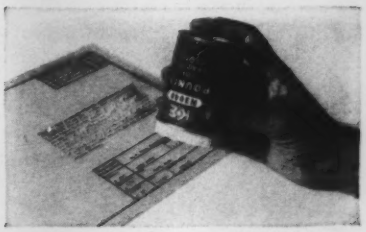


Moisten the eraser slightly. It becomes no more abrasive, but a lot more "erasive." Moistening is a must when removing Duralar lines or typing after exposure to heat. (Incidentally, don't use electric erasing machines, steel erasers or typewriter erasers.) When erasing large areas, certain chemical eradicators work fine too. Our suggestion: use Vythene or a very light application of a denatured alcohol such as Solox, both of which can be applied with a cotton swab or clean cloth.

The Cleaner the Better

HERCULENE Drafting Film was designed for ink work, and its ink take is unexcelled. But like all films, its non-absorbency makes a few preparations advisable. The surface should be cleaned thoroughly before inking. Quickest and most effective way to do this is with the ABC Draftsman's Dry-Clean pad, which will remove finger marks and "traffic film" simply by rubbing the pad over the surface. Pouncing will also work well. A damp cloth is all right for general cleaning, but does not do the best job of preparing the surface for ink.

Inking over graphite pencil lines comes out best when done over light lines, drawn with a harder grade of pencil. A good way to remove excess graphite is to go over the drawing with an ABC pad. Inks vary in their usefulness on HERCULENE. We've tested several, and you're welcome to these results as well, on request.



After Typing, Please Pounce

Typed impressions on HERCULENE Drafting Film are crisp and sharp, but may take a while to dry because the film's surface doesn't "swallow" ink readily. A light pouncing right after typing will dry the ink and fix the lines—giving you uniform permanent contrast.

A new typewriter ribbon will produce the best impressions. At K&E we've tested a healthy variety of ribbons and we'd be pleased to send you the results on request.

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We're pleasantly amazed at the short time it took for HERCULENE Drafting Film to become an accepted "staple"—along with ALBANENE® Tracing Paper and PHOENIX® Tracing Cloth. Actually, it's a rare drafting room by now that has *not* tested HERCULENE during its first year on the market. The findings: All properties considered, HERCULENE stands up better than any other drafting film. It has great resistance to heat, aging and abuse. Its exclusive "engineered surface" plus its tough, durable Mylar® base provide superior pencil and ink take, fine erasability, remarkable dimensional stability...a combination we're proud to call unbeatable!

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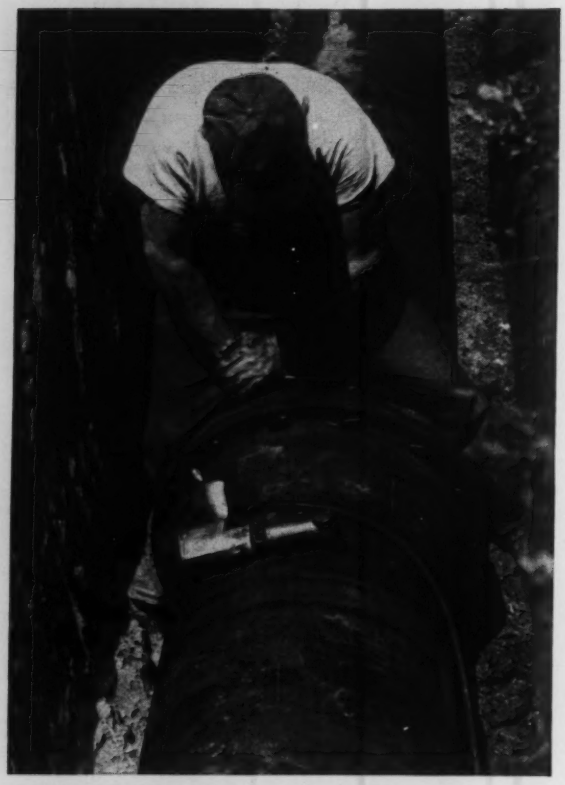
IT'S CAST IRON PIPE BY A

A country-wide survey of consulting engineers, just completed, asked this question: *What kind of pipe do you prefer for water distribution, and why?* Of the answers received, by far the greatest number named cast iron! Here are typical comments:

"This is known to be of 100-year life, and is the preference of this office when cost over this period can be used."

—Florida



"Our experience in the use of pressure pipe in the installation of water mains servicing communities has been limited entirely to cast iron. We have used nothing but cast iron all the way from 4″ to 24″ in diameter and have never regretted having done so."

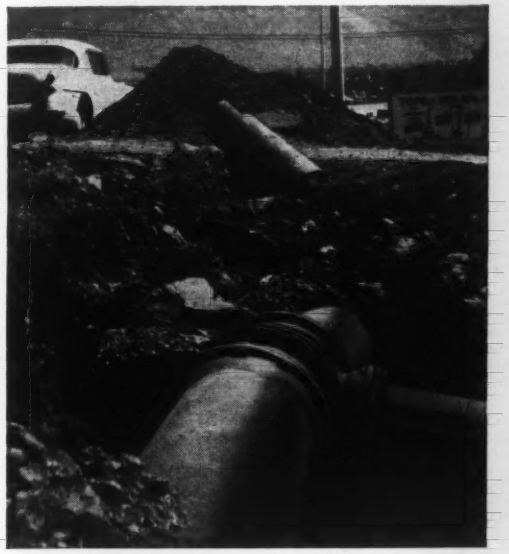
—Texas

"Longer length of life—comparative ease of installation—agrees with codes more readily."

—Ohio

(Vol. p. 69

LANDSLIDE!



"Long life, relatively inert material, flexibility of applications, and readily handled by maintenance crews of most owners."

—Alabama

"Durability, ease of taps, strength where installation conditions are not ideal."

—New York

So many good reasons . . .

- LONG LIFE. The cast iron pipe you install today will be performing economically a hundred years from now.
- HIGH CAPACITY FLOW. Cement-lined cast iron pipe will deliver the full-rated flow all through the years. No other pipe, size for size, can carry more water.
- CORROSION RESISTANCE. Long life proves it. Most water utilities are still using the first cast iron pipe they installed.
- GREAT BEAM STRENGTH. Cast iron pipe resists the effect of heavy traffic, shifting soils.
- TREMENDOUS LOAD RESISTANCE. 6″ cast iron pipe (Class 150) withstands a load of nearly 9 tons per foot!
- PRESSURE-TIGHT JOINTS. You have a complete choice of leakproof, easy-to-assemble joints. You need a minimum of tools and work crew.
- EASE OF TAPPING. No tapping saddles needed. Takes threading best of all kinds of pipe.

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Write for complete information to Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Ill.

RECENT BOOKS

(added to the Engineering Societies Library)

Advanced Structural Analysis

A comprehensive analysis of structural theory and its applications. The discussion on the various methods for determining deflections and for solving statically indeterminate structures is first presented, and then followed by advanced topics of current interest such as the theory of arches with reference to the deflection theory, numerical and approximate methods of analysis, torsion analysis, limit design, and temperature analysis. Special chapters deal with the basic theory and design methods of shell structures and with the use of electronic computers to solve structural problems. Throughout the book, an attempt is made to present the basic theory as completely as possible, and then to show the actual engineering applications of the theory. (By Sidney F. Borg and Joseph J. Gennaro. D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, N. J., 1959. 368 pp., bound. $7.50.)

Air Pollution Control

Presents the basic factors that should be considered in any air pollution control program. Beginning with an explanation of the effects of air pollution and the importance of meteorological variables, there follows a discussion of the nature and source of the more common air pollutants. Detailed consideration is then given to methods of determining the amounts of various contaminants in the air, the most appropriate means of controlling emissions at the source, and the legal means available for control. Newer aspects such as the automobile exhaust problem and the hazards of radioactivity are also discussed. (By W. L. Faith. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1959. 259 pp., bound. $8.50.)

Amenagements Hydroelectriques

Following a discussion of hydroelectric equipment within its historical and geographical framework, the author examines the fundamental principles of hydroelectric structures, the various types of dams, related structures (spillways, gates, conduits, intakes), and turbines and pumps. An appendix discusses the use of sale models in the determination of experimental values and the factors that influence the magnitude of these values. (By R. Ginocchio. Éditions Eyrolles, Paris, France, 1959. 480 pp., paper. 3500 fr.)

An Outline of Photogrammetry

Translated from the German, this text gives a reasonably concise presentation of the fundamentals, methods, instruments, and results of photogrammetry from a practical standpoint. Although German instruments and methods predominate, there is an attempt to cover achievements in other countries also. Topics discussed are terrestrial photogrammetry, aerial photography, plotting aerial photographs with simple equipment, rectification of single photographs, stereophotogrammetry, and applications of photogrammetry. (By K. Schwidefsky. Pitman Publishing Corporation, 2 West 45th Street, New York 36, N. Y., 1959. 326 pp., bound. $13.00.)

Architektur und Bauglas

The design and use of structural glass for buildings is fully covered with information on manufacture and properties, and detailed treatments of modern applications of glass blocks, slabs, framed panes, etc. Applications of special types of glass, such as for sound and heat insulation, are included. (By Oscar Knapp. VEB Wilhelm Knapp Verlag, Halle (Saale), Germany, 1958. 173 pp., bound. 29 DM.)

Applied Mathematics for Engineers and Scientists

Three broad aspects are encompassed in this volume, beginning with dynamics which encompasses the motion of a particle, the plane motion of a rigid body, vector analysis, and Lagrange's equations. In addition there is an account of Fourier series, harmonic analysis and small oscillations. This is followed by a discussion of statics, specifically statics of a rigid body, statics of strings and chains, and structural statics. The concluding chapters dealing with hydrodynamics treat the stability of floating bodies, Bernoulli's equation for liquids and gases, stream functions, and the standard atmosphere. A practical approach is maintained throughout, and numerous examples and exercises illustrate the solution of physical and engineering problems. (By C. G. Lambe. The Macmillan Company, 60 Fifth Avenue, New York 11, N. Y., 1958. 518 pp., bound. $8.50.)

A Record of History and Evolution of Early American Bridges

The development of American bridges and their design is covered in five chapters devoted to the pre-colonial period, post revolution period, post civil war period, and miscellaneous aspects. (By Llewellyn Nathanial Edwards. University Press, Orono, Me., 1959. 204 pp., bound. $5.00.)

ASTM Standards on Wood, Wood Preservatives, and Related Materials

Sixty-nine standards covering methods for establishing structural grades for wood and timbers, evaluating mechanical and physical properties of wood, methods of chemical analysis, fire tests, tests for panels for building construction, truss assemblies, and glued joints. (Published by the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., 1959. 446 pp., paper. $5.50.)

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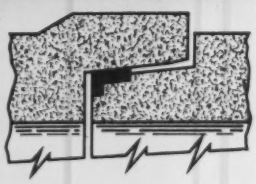

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A study of movable dams and water-intake systems in rivers, covering such aspects as rate of water flow, water level, drift of alluvial deposits, and flow through sluices. The construction of sluice gates, coffer dams, water-tapping devices, and sand and gravel filtering equipment is also discussed. (By M. Bouvard. Eyrolles, Paris, France, 1958. 238 pp., paper. 2600 fr.)

Beton Precontraint

Tome II: Constructions Hyperstatique

The second volume of a theoretical and practical treatise on prestressed concrete, this book treats of statically indeterminate structures such as beams, girder frames, concrete slabs, and arches. Their construction, elasticity, resistance to stress, and the relationship of the statically indeterminate structure to loss of tension are dealt with. The book concludes by deriving formulas for calculating the cracking and failure points of these structures under various kinds of stress. (By Y. Guyon. Eyrolles, Paris, France, 1958. 818 pp., bound. 9300 fr.)

Die Berechnung Der Zylinderschalen

Following the opening chapter on the fundamentals of shell theory, the author devotes each of the subsequent chapters to the calculation of full or partial cylindrical shells under various conditions. Particular attention is paid to barrel roof construction. The author uses the "model-shell" concept as a basis. There are over 200 references in a selected, chronological bibliography. (By A. Aas-Jakobsen. Springer-Verlag, Berlin, Germany, 1958. 160 pp., bound. 22.50 DM.)

Elsevier's Dictionary of Building Construction in Four Languages

Nearly 8,500 terms used in the building trade by contractors and architects are listed on an English alphabetical basis, and cover building materials, tools, and technical expressions. The corresponding terms in French, Dutch, and German are then given, arranged horizontally across the page. For each language there is an alphabetical list of words referring to the corresponding English term. (By C. J. Van Mansum. D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, N. J., 1959. 471 pp., bound. $15.75.)

Energy for Man

A long-range, non-technical survey of the production of energy for man's use and the problems arising from the ever-increasing need for power in our technological civilization. The author discusses the major prime movers for power generation and the fuels involved; in addition he considers solar energy, atomic energy and nuclear reactors, thermo-nuclear reactions, and heat pumps, with very brief mention of wind, tidal, and geothermal power. (By Hans Thirring. Indiana University Press, Bloomington, Ind., 1958. 409 pp., bound. $6.95)

Ground Water Hydrology

An account of ground water hydrology that presents the fundamentals of the subject as well as recent methods being used in the field. The basic quantitative aspects relating to use, occurrence, movement, water wells, and ground water levels are followed by discussions of ground water quality, conservation of ground water, methods of investigating ground water by surface and subsurface procedures, artificial recharge, and sea water intrusion. A review is also given of the various types of laboratory model and numerical analysis studies. (By David K. Todd, John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1959. 336 pp., bound. $10.75.)

Hot Organic Coatings

The constitution, application, and properties of such hot organic materials as asphalt, coal tar pitch, petroleum waxes, and cellulose derivatives are presented. Hot melt applications without solvent such as peel coatings, protective linings, flame spraying and the fluidized bed process are then discussed, and a special chapter is devoted

(*Continued on page 122*)

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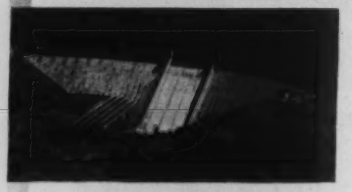
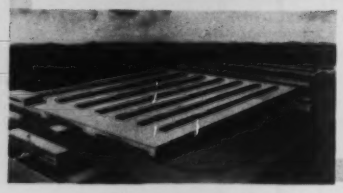
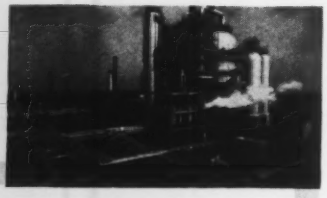
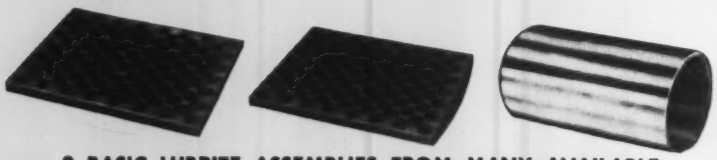




- Permit simplified designs
- Cut construction costs
- Eliminate maintenance
- Low coefficient of friction



Lubrite offers positive assurance of self lubricating security in all installations where expansion, contraction and/or rotation are factors.



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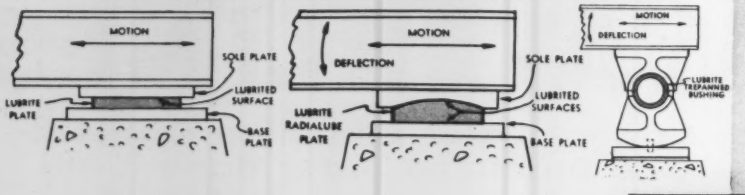

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Recent Books

(*Continued from page 121*)

to hot applied coal tar pitch base coatings. Hot spray techniques and their advantages are also covered. (By Raymond B. Seymour. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y., 1959. 233 pp., bound. $7.50.)

Industrial Building Details

Second Edition

A reference tool that provides a collection of industrial architectural details drawn precisely to scale. The drawings are sharp, legible, clearly labeled, and large enough to facilitate tracing or projection. Among those details given are walls, windows, louvers, roofs, floors, ventilators, expansion joints, doors, stairs, landings, platforms, catchbasins and manholes, storage and transport facilities and many others. (By Duane F. Roycraft. F. W. Dodge Corporation, 119 West 40th Street, New York 18, N. Y., 1959. 356 pp., bound. $12.75.)

International Association for Bridge and Structural Engineering, Publications, 1958

Papers dealing with such topics as analyzing deformations of plane trusses, general instability of low framed buildings, bending of a sectorial plate, stability of pony-truss bridges, stability of rib-reinforced cylindrical shells under lateral pressure, cyclic loading of portal frames, analysis of thin elastic shallow segmented shells, and a model continuous beam bridge with steel deck. Papers are written in English, French, and German with summaries of each paper in all three languages. (Published for the Association by Verlag Leeman, Zürich, Switzerland, 1958. 296 pp., paper. 38 DM.)

Library Services

Engineering Societies Library books may be borrowed by mail by ASCE members for a small handling charge. The Library also prepares bibliographies, maintains search and translation services, and can supply a photoprint or microfilm a copy of any items in its collection. Address inquiries to R. H. Phelps, Director, Engineering Societies Library, 29 West 39th Street, New York 18, N. Y.

Professional Engineering Examinations

Part I—Structural Planning and Design

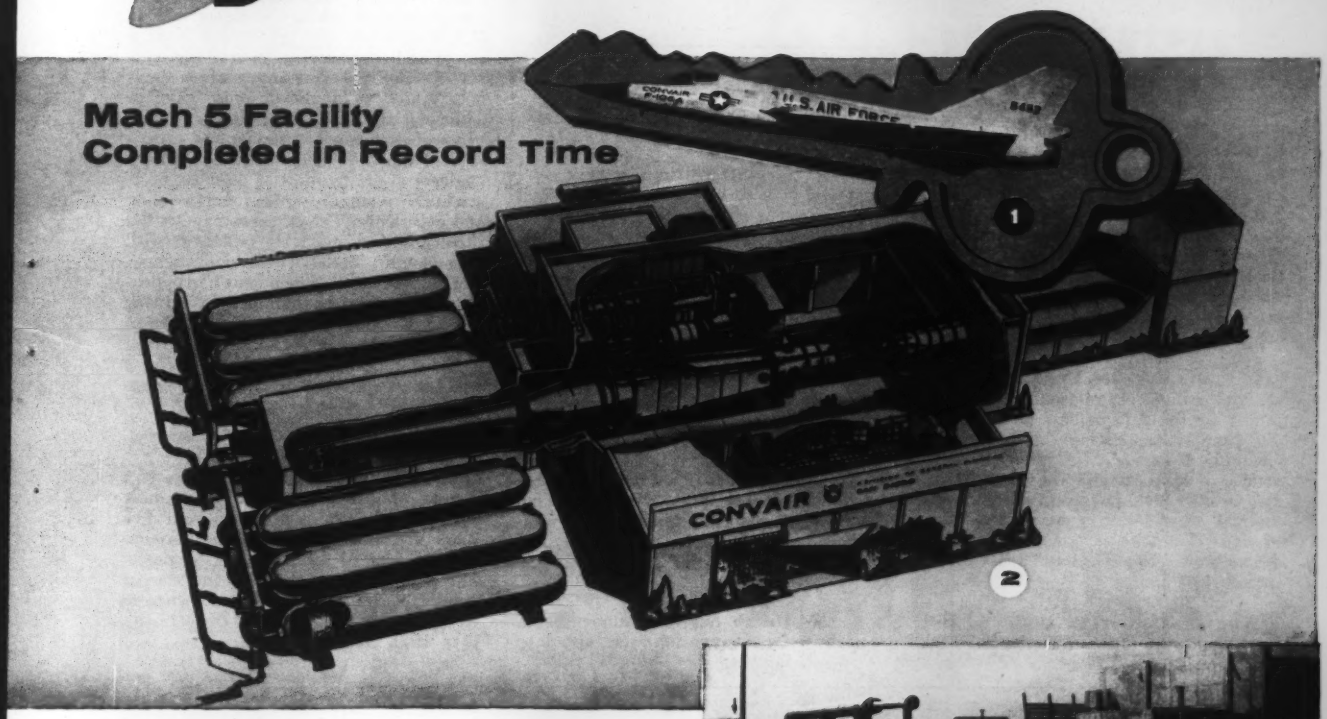
A new edition that provides detailed solutions to past New York State engineering examinations. Topics covered include design and investigation of concrete beams, slabs, and columns; design of timber beams and joists; design, selection and determining safe load of steel columns, beams and girders; riveted joints and sections; and various other aspects of the subject. (By William Glendinning. Published by the author, 5123 Bell Boulevard, Bayside, N. Y., 1959. 116 pp., paper. $3.25.)

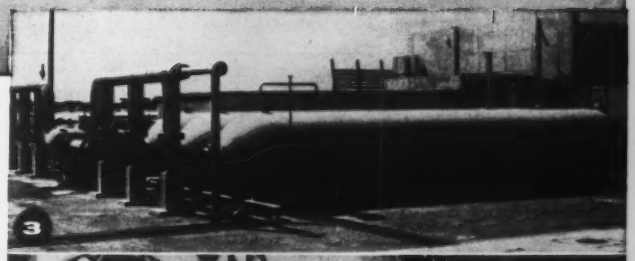
Reinforced Concrete Fundamentals

Emphasis is placed on the physical behavior of reinforced concrete members and the approved ultimate strength theory. Included are enough details of ultimate strength design for practical use, information on the American Concrete Institute Building Code requirements, and a comparison between ultimate strength and working stress analysis. Additional features of the book are a thorough treatment of slabs, working stress methods in detail, and an emphasis on anchorage length as well as moment in its coverage of bend points for steel. (By Phil M. Ferguson. John Wiley and Sons, Inc., 440 Fifth Avenue, New York 16, N. Y., 1958. 604 pp., bound. $11.50.)

(*Continued on page 125*)

CB&I turns the key on construction of Convair Supersonic Wind Tunnel





CB&I specialists, working in cooperation with *Flui Dyne* Engineering Corporation, handled the engineering, fabrication and assembly of this country's first "turn-key" supersonic wind tunnel. Built for Convair Division of General Dynamics Corporation, the intermittent *blow-down* type tunnel is capable of simulating speeds that range from Mach 0.5 to 5 (five times the speed of sound).

This $3,500,000 project for Convair is one of several supersonic test facilities in which the coordinated facilities of CB&I are playing a major role. These same engineering, fabrication and erection services can provide *you* with the benefits of *one source craftsmanship in steel*—with which CB&I has served industry, science and government for almost seven decades. Write our nearest office for a copy of the *Convair Story*.

E62CB

1. F-106 A **Delta Dart,** supersonic all-weather interceptor being manufactured by Convair for the United States Air Force.

2. Sketch shows major components of CB&I-built 3,700 MPH wind tunnel at Convair plant, San Diego, California.

3. Six CB&I-built tanks store air at 600-psi for intermittent blow-down type tunnel.

4. Tunnel "throat" or nozzle is comprised of flexible plates to generate flow from Mach 1.6 to 5—was precision assembled to few thousandth of an inch accuracy.

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Australia, Cuba, England, France, Germany, Italy, Japan, Netherlands, Scotland

Non-ASCE Meeting

(*Continued from page 116*)

quests for registration forms should be addressed to the Conference Registrar, Instrument Society of America, 313 Sixth Avenue, Pittsburgh 22, Pa.

National Safety Council. Forty-seventh annual congress at the Conrad Hilton Hotel, Chicago, Ill., October 19-23. Advance information from the National Safety Council, 425 No. Michigan Avenue, Chicago 11, Ill.

Pacific Northwest Sewage and Industrial Wastes Association. Annual meeting at the Tioga Hotel, Coos Bay, Ore., October 29-31. Requests for information should be sent to Gilbert H. Dunstan, Secretary-Treasurer, P. O. Box 176, Pullman, Wash.

Pennsylvania State University. Ninth annual drilling symposium sponsored jointly by the departments of mining of the Pennsylvania State University, the Colorado School of Mines and the University of Minnesota at University Park, Pa., October 8-10. For reservations or additional information contact the Continuing Education Conference Center, Pennsylvania State University, University Park, Pa.

Wire Reinforcement Institute. Fall meeting at the Queen Elizabeth Hotel, Montreal, Quebec, Canada, October 1-2. Further information from Frank B. Brown, Managing Director, Wire Reinforcement Institute, National Press Building, Washington 4, D. C.

Positions Announced

U. S. Navy. Opportunities exist for civil and structural engineers interested in working in the Pacific area—Grades GS-5 through GS-12. Salaries range from $4,490 to $8,810 plus additional allowances or differentials. To qualify applicants must have completed a four-year or longer professional course in engineering or a closely related field at an accredited college or show the equivalent combination of experience with acceptable college-level engineering education. In addition there is an opening for a welding engineer, GS-9 to GS-11, $6,285-$7,510 plus a 20 percent cost of living allowance. Applicants for this job must fulfill the requirements already listed with the further "must" qualification of two years of professional engineering experience for GS-9 and two and a half years for GS-11.

Public Health Service. Announces a competitive examination for appointment of sanitary engineers as officers in the Regular Corps of the U.S. Public Health Service Commissioned Corps. Exam dates are November 17, 18, 19, and 20, 1959. Requirements for the grades of junior assistant engineer, assistant, and senior assistant sanitary engineer include U.S. citizenship and graduation from a recognized engineering college or university. For the assistant sanitary engineer grade, an applicant must have in addition, at least, three post-graduate years of professional training and experience, while the senior assistant sanitary engineer grade requires at least six post-graduate years of professional training and experience. The entrance pay for the three grades respectively is $4,268 (with dependents), $4,817 (with dependents), and $6,270 (with dependents). Application forms may be obtained by writing to the Surgeon General, United States Public Health Service (P), Washington 25, D. C. Completed application forms will be accepted no later than October 9, 1959.

City of Riverside (Calif.). There is a vacancy for a graduate civil engineer having California registration and five years of responsible municipal experience for the post of assistant city engineer. The salary ranges from $739 to $899 per month. Those interested should write to Robert N. Briley, Personnel Department, City Hall, Riverside, Calif.

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Recent Books

(Continued from page 122)

Technology in American Water Development

In this volume water control technology is related to water development and water policy decisions. A preliminary section on the physical and economic environment of water development is followed by discussions on techniques and technical events affecting the progress of water development, emerging technology and its potential impact on water use, and organizational responses to problems and opportunities for water development introduced by technologic change. Thirty-one case histories are presented to illustrate the concepts involved. (By Edward A. Ackerman and George O. G. Löf. The Johns Hopkins Press, Homewood, Baltimore 18, Md., 1959. 709 pp., bound. $10.00.)

Tignes

This group of papers by engineers connected with the work, covers fully the hydraulic installations of Tignes in the French Alps. The Tignes Dam, one of the highest in the world, is described in detail, as are the problems encountered in its construction. The power plants at Brévière, Le Chevril and Ponturin, and the central plant at Malgovert are similarly treated. The book is profusely illustrated with photographs and diagrams. (Published by La Houille Blanche. Distributed by Editions Eyrolles, Paris, France, 1958. 440 pp., bound. 8000 fr.)

The Building of the TVA

An illustrated history of the TVA written in honor of its 25th anniversary. The twenty dams and eight steam plants extending over five states and 41,000 square miles in the Tennessee River Basin are described and profusely illustrated with diagrams and photographs. (By John H. Kyle. Louisiana State University Press, Baton Rouge 3, La., 1958. 162 pp., bound. $7.50.)

Tunnel Engineering

A comprehensive survey of tunneling methods and recent developments that have affected tunneling practice. After giving a brief history of tunneling, the book covers lining methods (with practical examples), shield tunneling, and subaqueous tunneling. It continues with a chapter on rock tunneling which covers shaft sinking problems, drilling, blasting, rock falls, and shattering. Concluding sections deal with tunneling through difficult ground, and such problems as temperature control. (By Rolt Hammond. The Macmillan Company, 60 Fifth Avenue, New York 11, N. Y., 1959. 332 pp., bound. $11.00.)

Water Facts for the Nation's Future

The first part of this volume describes and comments on current government programs for gathering hydrologic and hydroclimatic data, as well as data on water use and development. The present mapping program is discussed, and a chapter is devoted to the question of design of an adequate national hydrologic network. Part two discusses how well all this information now being gathered is being applied to meet water control and utilization problems. Phases of water management treated are irrigation, flood control, streamflow forecasting, and waste-water disposal. (By Walter B. Langbein and William G. Hoyt. The Ronald Press Company, 15 East 26th Street, New York 10, N. Y., 1959. 288 pp., bound. $5.00.

Zehnteilige Einflusslinien fur Durchlaufende Trager

Band I

Vol. I of this useful reference work, "Ten-division influence lines for continuous beams," gives a detailed treatment of the derivation and use of equations for the rapid and accurate calculation of continuous beams in cases of arbitrary number of spans, span lengths and loads, and for various bearing conditions at the end supports. Extensive graphical and tabular data are included to facilitate its practical use. (By Georg Anger. Wilhelm Ernst and Sohn, Berlin, Germany, 1958. 271 pp., bound. 41 DM.)

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(Old Designation)

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(New Designation)

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PHILIP ALEX BURTON, West Hartford, Conn.
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[Applications for the grade of Associate Member from ASCE Student Chapter Members are not listed.]

B - 451

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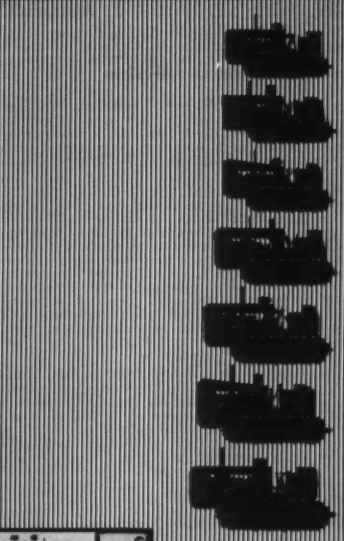
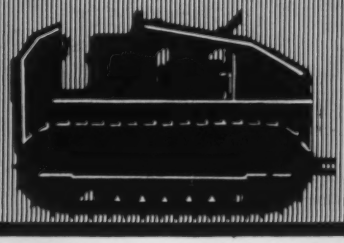
NOT THE CLAIMS

	EIMCO 103	CAT D-4	CAT D-6	AC HD-6	AC HD-11	INT. TD-9	INT. TD-15	CASE 1000
Maximum Drawbar Pull (Less track slippage)	33,000	19,700	29,000	15,485	21,900	13,240	20,730	24,000
Torque Converter	Yes	No	No	No	No	No	No	Yes
Master Clutch	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Power shift transmission on all speeds, with all sealed metallic clutches that never need adjustment	Yes	No	No	No	No	No	No	No
Independently reversible track	Yes	No	No	No	No	No	No	Yes
Hydraulic track take-up	Yes	No	No	No	No	No	No	Yes
Heat-treated alloy steel grouser shoes, keyed to the track links	Yes	No	No	No	No	No	No	No
One-piece heat-treated alloy steel track rollers, tapered roller bearings	Yes	No	No	No	No	No	No	No
Equalizer bar of heavy duty heat-treated nat alloy steel, allowing full oscillation of crawler tracks with all attachments	Yes	No	No	No	No	No	No	No
Constantly running power take-off drive, front and rear, to standard SAE spots, with rear take-off not affected by track operation, and independent hydraulic pump drive allowing simultaneous use of hydraulic, winch and hoist accessories	Yes	No	No	No	No	No	No	No
Front operator's seat for full visibility	Yes	No	No	No	No	No	No	No
Ability to operate forward and backward on up to 90% slopes	Yes	No	No	No	No	No	No	No
Tractor guaranteed for one full year of single shift service	Yes	No	No	No	No	No	No	No
WEIGHT BARE TRACTOR, POUNDS	15,000	10,910	17,600	12,000	20,500	11,925	22,540	15,300
H.P. — FLYWHEEL	100	60	93	66	99	71	105	90
TRACK GAUGE, INCHES (STD.)	60	60	74	60	74	60	74	60
STD. TRACK SHOE WIDTH, INCHES	16	12	16	13	16	13	16	16
LENGTH OF TRACK ON GROUND, INCHES	88	61	85¾	66½	85¾	73	89¾	79
TOTAL TRACK AREA, SQ. INCHES	2,820	1,389	2,744	1,739	2,744	1,896	2,888	2,528
GROUND PRESSURE, PSI.	5.3	6.9	6.4	7.3	7.5	6.3	7.9	5.3
TRACK ROLLER DIAMETER, INCHES	8	8	8	7⅞	7⅛	N.A.	10⅛	6
TRACK RAIL WIDTH, INCHES	1⅜	1⅜	1¼	1⅝	1⅜	N.A.	N.A.	1⅝
NUMBER TRACK ROLLERS, EACH SIDE	6	4	6	5	6	5	6	5
TRACK BOLT DIAMETER, INCHES	⅝	⅝	⅝	⅝	⅝	⅝	⅝	⅝
TRACK BUSHING DIAMETER, INCHES	2 21/32	2	2⅜	2	2⅜	2⅜	2¼	1 29/32
TRACK PIN DIAMETER, INCHES	1 11/32	1⅜	1¼	1⅜	1¼	1⅜	1⅛	1¼
SPROCKET PITCH DIAMETER, INCHES	32½	29¼	30⅛	28⅞	31⅛	28¼	30⅛	24⅛
GROUND CLEARANCE, INCHES	17	11⅛	12⅛	11¼	12⅛	10⅝	11	16

N.A. — not available

"PROOF OF" EIMCO 103 SUPERIORITY





Above is from manufacturer's data and other sources believed to be reliable, but cannot be guaranteed.

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133 — STEEL MILL FEL
143 — LOG LOADER

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When making application for a position include 8 cents in stamps for forwarding application to the employer and for returning when possible.

Men Available

CIVIL ENGINEER, A.M. ASCE, B.S.C.E., P.E., age 28. Six years of planning and supervisory experience in railroad construction work, particularly bridges. Interested in expanding experience in civil engineering field. Location, United States. C-445.

FIELD ENGINEER, A.M. ASCE, B.C.E., age 25. Three years' experience in field and office assisting in the supervision of construction of heavily reinforced concrete structures. Reviewed and supervised the review of contracts, plans, and specifications, for roads, walks, foundations, airfield pavements, drainage and flood control structures; performed soils tests; prepared change orders and addenda to contracts; and prepared estimates and economic studies for foundations and soils problems. Location, Greater Metropolitan area. C-478.

SUPERVISORY CONSTRUCTION MANAGEMENT ENGINEER, M. ASCE, B.C.E., graduate studies in civil engineering; age 33. Ten years' experience in heavy construction of supervisory capacity. Design experience as well as field experience in highways, air bases, all types of pavements, structures, materials and testing and radar sites. Desires position in supervisory capacity; speaks Spanish. Present location Spain. Location, U.S.A., Europe, South America. C-479.

STRUCTURAL ENGINEER-CONSTRUCTION, A.M. ASCE, B.S.C.E., age 25. For three years in charge of engineering department of Naval Station gaining varied design experience, extensive experience as comptroller construction funds and as manager of construction-department personnel and contract. Reinforced concrete design for hospital and library for architect. Two construction seasons as Massachusetts highway construction inspector, plus two seasons with company on general construction at various trade levels. Location, Foreign, or West Coast U.S. C-480.

CIVIL ENGINEER, M. ASCE, registered Connecticut and Colombia. Seventeen years of recent construction and office experience in Europe and Latin America. Wishes connection with general contractor or consultant as adviser and estimator to investigate new business abroad. Last assignment was reporting on large hydro and water supply project in the West Indies. Location preferred: East or Foreign. C-481.

ESTIMATOR, General Construction, A.M. ASCE, B.C.E., age 29. Two years as engineer-estimator on estimates, takeoff quantities, purchase materials, layouts, as assistant field superintendent and coordinator of subcontracts. Location open. C-482.

FIELD ENGINEER, A.M. ASCE, B.S.C.E., age 32. Eight years of industrial construction experience as field engineer, office engineer and estimator. Location, Atlantic Coast from Virginia to New York State. C-483.

JUNIOR CIVIL ENGINEER, A.M. ASCE, B.C.E., age 22. Recent graduate with some experience in layout and supervision of small buildings and sanitary landfills. Will accept any challenging position anywhere. C-484.

ADMINISTRATIVE ENGINEER, A.M. ASCE, B.C.E., age 32. Nine years of administrative experience, field, office and foreign, in large engineering-contracting firm, small consulting firm and own construction materials business. Experience included project engineering, scheduling, budget status and manpower commitment studies, supervision of drafting, purchasing, market analysis, direction of sales, advertising, promotion, financing, insurance, hiring, training, supervising personnel. Location, New York area. C-485.

PROFESSOR OR RESPONSIBLE SANITARY ENGINEERING POSITION in industry, M. ASCE, B.S.C.E., M.S., Ph.D., age 40. Five years of experience in general civil engineering; one and a half years of experience in teaching; eight years of design and research experience in sanitary engineering with consulting engineers and industry. Location, U.S.A. C-976-Chicago.

CIVIL ENGINEER, M. ASCE, B.S.C.E., age 29. Eight years' experience in office and field, working as construction superintendent, project engineer, assistant resident engineer and assistant project manager on bridges, highways, industrial, commercial and education buildings. Experienced also on design and estimating. Will relocate. C-486.

ENGINEER-SUPERINTENDENT experienced on institutional work; cost conscious. Location, Long Island, New York. W-7714.

ENGINEER, Public Health, degree, and diversified experience in public health engineering to assume full responsibility for all phases of watershed control work, including administration of department and supervision of personnel. Location, northern New Jersey. W-7726.

ENGINEERS. (*a*) Conservation engineer, experienced in the economics of fish and wild life problems and recreation developments. Salary, $10,000 a year. (*b*) Hydraulic engineer, experienced in ground-water hydrology. Salary, $10,000-$12,000 a year. (*c*) Hydraulic engineer, experienced in stream pollution abatement problems. Salary, $10,000-$12,000 a year. (*d*) Analytical engineers who have specialized in financial analysis and economics of navigation, flood control and similar developments. Salary open. Location, Southwest. W-7735.

CIVIL ENGINEERS with at least five years' highway design and construction supervision. Working knowledge of Spanish required. (*a*) Project manager. Salary, $16,800 a year, plus $300 a month allowance. (*b*) Assistant project manager. Salary, $15,600 a year, plus $300 a month allowance. (*c*) Office engineer. (*d*) Soils and materials engineer. (*e*) Road design engineer. (*f*) Bridge designer. (*g*) Drainage and hydraulic engineer. (*h*) Location engineer. (*i*) Construction engineer. (*j*) Assistant construction engineers. (*k*) Chief accountant and administrator. Salaries, $12,000-$14,400 a year, plus $300 per month living allowance. Altitudes to 15,000 feet. Duration, two to three years. Location, South America. F-7769.

WATER SUPPLY ENGINEER, civil graduate, with ten years' experience in well and general hydraulics including fire protection in chemical plants. Salary, $10,800 a year. Location, New York, N. Y. W-7770(*b*).

CIVIL ENGINEERING FACULTY POSITION for teaching and research in transportation, surveying, planning. Salary and rank open. Location, Midwest. W-7797.

STRUCTURAL ENGINEER, C.E. or Architectural engineering degree; to 45, with three years' structural design or architectural experience, knowledge of building industry. Duties: Prepare installation drawings and cost estimates, structural design reviews, product design table, product standards and specifications and some field work for a manufacturer of steel products. Employer will negotiate placement fee. Salary open. Location, Missouri. C-7573.

SANITARY ENGINEER, graduate civil or sanitary engineer, with two or more years' experience. Varied duties, including all phases of work in the field and office for a manufacturer of water and waste treatment equipment. Travel; no car required. Employer might negotiate placement fee. Salary, $7,200 a year. Location, Chicago. C-7574.

STRUCTURAL DESIGN—CONSULTANT, CONTRACTOR, A.M. ASCE, age 29. Five and one-half years as structural designer for commercial and industrial buildings, heavy equipment structures, powerhouses, and steel and timber bridges for consultants and manufacturers; one year as assistant transportation engineer on traffic surveys for the government. $7,000. Location, San Francisco Bay Area. S(M)-1300.

DESIGN—HIGHWAYS, AERONAUTICAL: A.M. ASCE, age 25. Five months planning, estimating for roads for highway department; nine months stress analysis reports on military aircraft structures. $450 per mo. Prefers Southwest, California. Home Texas. S(M)-1172

DESIGN, CONSTRUCTION, MAINTENANCE—NUCLEAR, MILITARY: M. ASCE, age 44. Sixteen and one-half years in charge of planning, designing, constructing, and maintaining of nuclear facilities, air force bases; one year plan, specifications, construction, schedule, inspection for construction company; two years junior civil on land acquisition, design of highways, construction estimates for government. $16,000. Locate, West, Southwest, Foreign. S(M)-683.

STRUCTURAL DESIGN—CONSTRUCTION, M. ASCE, California Civil Engineer License, age 39. Ten years in responsible charge of planning, design, specifications on industrial and commercial buildings, water treat plants, steel mills, chemical plants for construction companies; five months as field engineer on Air Force base barracks and mess halls for construction company; and one and one-half years' estimating and steel detailing for fabricator. $900 per mo. Location, San Francisco Bay Area. S(M)-1872.

TEACHING—ENGINEERING MECHANICS, M. ASCE, PhD Mech., age 32. Three and one-half years' teaching engineering mechanics and one year research for university. $8,500 for nine months. Location, East or West Coast. S(M)-1823.

HYDRAULIC ENGINEER—CONSULTANT, UTILITY, A.M. ASCE, California Civil Engineer License,

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age 54. Seven years as senior hydraulic engineer, consulting, designing and constructing earthfill and concrete dams, powerhouses and hydro plants for consultants; three and one-half years as water resources specialist, designing, constructing and drawing up specifications on dams, for engineers-constructors and two years as specification writer for military construction. $800 per mo. Any location. S(M)-1597.

DESIGN, PLAN—HIGHWAY, PUBLIC WORKS, A.M. ASCE, age 30. Three years in charge of geometrics, traffic, design and supervision of plans, on freeways and urbanways, for consultant; one and one-half years on design, research, test equipment, soils, and asphaltic mixtures for university; two years as junior civil engineer on highways. $9,600 up. Location, northern California, West Coast. S(M)-1550.

PROJECT MANAGER, F. ASCE, B.S., M.S. & C.E., age 47. Twenty-three years of experience as corporate engineer for construction programs in aluminum and chemical industries, also experienced in profitability analysis, cost estimation, project planning, cost control and field construction management. C-487.

EXECUTIVE ENGINEER, M. ASCE, Master of C.E., Registered Civil Engineer—California, age 46. Twenty years in administration and supervision of design and construction of airfields, waterfront work, buildings and utilities. Location desired, West, South, or Foreign. C-488.

Positions Available

DIRECTOR (Trainee), for school of civil engineering. Must have a degree in civil engineering, with a minimum of two years' work experience in the field of civil engineering. Writing or teaching experience desirable. Will be required to learn the direction of instruction services and the preparation of instructional materials. Salary while training, $6,000-$6,500 a year. Location, East. W-7633.

STRUCTURAL ENGINEER, with three to five years of experience in construction design of industrial process buildings including both steel and concrete work. Should be familiar with structural problems on tanks, pressure vessels and equipment supports and should be interested in expanding scope of knowledge to include all phases of chemical industrial engineering design. Salary open. Location, Midwest. W-7645 (a).

STRUCTURAL ENGINEER, under 40, preferably a graduate degree with specialization in structural engineering. Several years' experience along structural lines. Will be responsible for design and construction of equipment, buildings and structures. Should have management potential. Salary, to start, to $10,800 a year. Location, Midwest. W-7654.

SOILS ENGINEER, master's degree in soil mechanics; registration desirable but not necessary, for position as assistant manager in growing foundation engineering and testing corporation. Profit sharing. Location, Midwest. W-7883.

STRUCTURAL DESIGNER, civil or structural engineer with three or more years' experience in structural steel and reinforced concrete design to design grain elevators, cement plants, etc. Employer will pay placement fee. Salary, $7,800-$10,200 a year, plus fringe benefits. Location, Minnesota. C-7612.

STAFF ENGINEER, structural (architectural training desirable adjunct) with thorough experience in design of concrete, steel and timber structures for commercial, industrial and institutional buildings. Must be capable of developing plans for industrial and warehouse structures, design, working drawing supervision and preparation of specifications and field direction of construction. Capable of scheduling work for staff of ten Junior Engineers and work cooperatively with two active and precise principals. Multi-story experience desirable. Must have profession or structural engineering license. Firm enjoys reputation as young aggressive competent firm serving the principal architects and industry for Wisconsin. Excellent opportunity for experienced man seeking position for future. Salary open. C-7622.

ASSISTANT RIGHT OF WAY AGENT—UTILITY, graduate or equivalent and two years of experience in one of the following: Real property or right of way acquisition, real estate brokerage, appraisal, title examination, map drafting, surveying instrumentman or preparation of documents concerning real propertyrights, land description and records, preparation of legal instruments used in transfer of title. $530-591. San Francisco Bay Area. U.S. Citizen. S(P)-4536.

LAND SURVEYOR OR LICENSED CIVIL ENGINEER specializing in land surveying to become associated in engineering-surveying office. Preferably under 40. Salary plus percentage of survey work. San Joaqun Valley. S(P)-4539.

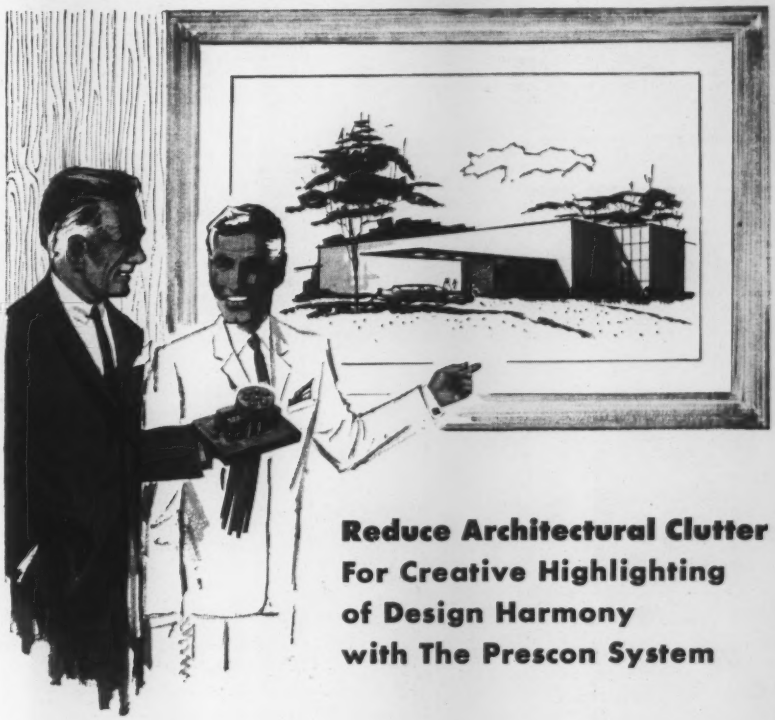
This is only a sampling of the jobs available through the ESPS. A weekly bulletin of engineering positions open is available at a subscription rate of $3.50 per quarter or $12 per annum for members, $4.50 per quarter or $14 per annum for non-members, payable in advance.

FIELD ENGINEER—PULP MILL, civil engineer, 25-35; to take charge of field crew, lay out work, control levels, inspection field reports, job progress. On boiler house job, lasting approximately one and one-half years. $575-675 per mo. Employer pays placement fee. Northwest. S(P)-4509.

OFFICE ENGINEER—BOILER HOUSE CONSTRUCTION, civil engineer, 25-35. Field drawings, changes, cost, records on boiler house job for pulp mill, for approximately one and one-half years. $550-650 per mo. Employer pays placement fee. Northwest. S(P)-4508.

STRUCTURAL ENGINEER (PROJECT LEVEL)—PULP MILL, civil or structural engineer, 25-35; married. Five to ten years of experience in steel and concrete design, including some experience on cost estimating and specifications, contracts, field supervision of construction, for planning of building additions, changes, major repairs for pulp mills, complete working drawings of buildings of steel, reinforced concrete, timber construction; cost estimates, contracts and specifications, field supervision and inspection of contractor's work on building construction and equipment installation. $500-600 per mo. Employer pays placement fee. Northwest. S(P)-4506.

CONSTRUCTION SUPERINTENDENT—SUBDIVISION, licensed civil engineer in California, to superintend placing of subdivision work, layout, surveys, follow through, construction of streets, sewers on public works. $880-1,070 per mo. San Francisco. S(P)-4476.



Reduce Architectural Clutter For Creative Highlighting of Design Harmony with The Prescon System

Architects and other creative designers seeking to eliminate the "architectural clutter" of old style supporting members and overly massive beams find the Prescon System of post-tensioning prestressed concrete allows design harmony of long spans and fewer columns with the high strength and lightweight so in demand in modern structures.

Simplified, economical yard, jobsite, or in place casting of long span girders and lightweight decking members often cuts costs as much as 25% below other methods and materials.

Exercise true architectural control over your structures . . . call your Prescon representative for specialized assistance to your engineer and for recommendations using the Prescon System in industrial and general purpose buildings, utilizing lift slab, poured-in-place, or precast members.

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MEMBER PRESTRESSED CONCRETE INSTITUTE

PREVIEWS OF 1959 CIVIL ENGINEERING SHOW

STATLER-HILTON HOTEL, WASHINGTON, D. C., OCTOBER 19TH–23RD

In cooperation with the manufacturers and suppliers who are participating in the Civil Engineering Show being held in Washington, October 19th-23rd, the following brief descriptions are offered.

Acker Drill Co., Inc.—Booth #38 & #39—Experienced personnel will be on hand to discuss soil sampling techniques and problems. In addition, actual cut-aways of popular soil sampling tools, such as the Denison Core Barrel and Precision type Torque Head Vane Shear Tester will be shown.

Aero Service Corp.—Booth #22—The company plans to exhibit refined and developed photogrammetric techniques showing how electronic computing devices help to cut highway mapping costs and speed surveys. Various samples of aerial photography, photo contour maps, photo analysis of soils studies, and topographic maps will be displayed also.

American Concrete Pipe Association—Booth #31—Information relating to the manufacture of, engineering data on, and uses of concrete pipe for sewers and culverts, will be available.

American Concrete Pressure Pipe Association—Booth #32—The company will make available engineering data plus information on the use and installation of concrete pressure pipe for water lines, distribution mains and sewer force mains.

American Cyanamid Co., Commercial Development Div.—Booth #18—The manufacturer expects to devote the entire booth to AM-9 Chemical Grout, a product that represents a new concept in the field of soil stabilization and grouting.

Armco Drainage & Metal Products, Inc.—Booth #40—The company will exhibit pictorial descriptions of research, design, and installation aids on water control gates, drainage structures, foundation piling and other steel construction products.

Bendix Computer, Div. of Bendix Aviation Corp.—Booth #4—The following equipment will be on display and in operation: G-15 General Purpose Digital Computer and the MTA-2 Magnetic Tape Unit Accessory. There will be material on the Intercom 1000 simplified programming system.

Chicago Pump Co.—Booth #45 & #46—Information on the company's complete line of Sewage and Industrial Wastes Treatment Equipment will be available. Signs and a few backdrops will be on display to highlight this equipment.

Civil Engineering Magazine—Booth #50—Literature and reprints will be available giving examples of the publication's editorial services. Also pamphlets and displays point out the advantages of Civil Engineering as an advertising medium.

Engineering News-Record—Booth #41 & #42—Reprints of recent articles of interest to Civil Engineers will be available.

Fairchild Aerial Surveys, Inc.—Booth #33—The company will present a summary of all various services applicable to problems faced by civil engineers. This will include information on aerial photography, topographic mapping, electronic positioning, and techniques of airborne geophysical exploration.

The Geodimeter Co., Div. of Berg, Hedstrom & Co., Inc.—Booth #1—Geodimeter Model 4 and related items will be on display. This instrument is an electronic distance measuring device utilizing the speed of light to accurately determine distances up to 5 miles.

Granco Steel Products Co.—Booth #34—S-I-P (Stay-in-Place) Bridge Deck, the new system for forming bridge deck concrete slabs, will be featured. Granco's Guard Rail and Steel Pavement Joints will also be shown.

The Kalman Co.—Booth #19—A series of photographs showing poor industrial floors, the difficulties they can cause, and how good concrete floors can be obtained, will be featured.

Karol-Warner Inc.—Booth #9—The exhibit will feature a new Triaxial Testing Machine for soils. This will be the first public showing of the model, which incorporates as standard equipment many accessories previously available only as separate devices.

Kern Surveying Instruments, Inc.—Booth #26—A complete line of surveying instruments will be displayed. The outstanding instrument in this line is the DKM1 Double Circle Theodolite which will meet specifications for the most exacting work in building, engineering, and geodetic applications.

Leupold & Stevens Instruments, Inc.—Booth #17—The instruments that the company intends to display will be entirely devoted to the Hydrographic line. This will include some of the new designs which recently have been perfected and also the standard models.

W. R. Meadows, Inc.—Booth #47—Information on Sealtight "Premoulded Membrane", Corktite Perimeter Insulation and Sealtight PVC Waterstops will be available at the company's display booth at the Civil Engineering Show.

National Pool Equipment Co.—Booth #14—The manufacturer will feature its line of modern swimming pools, which are produced in a wide range of sizes and shapes and are fully equipped as required with all filters, heaters, underwater lights, skimmers, chlorinators, fittings, vacuum cleaners, ladders and other accessories.

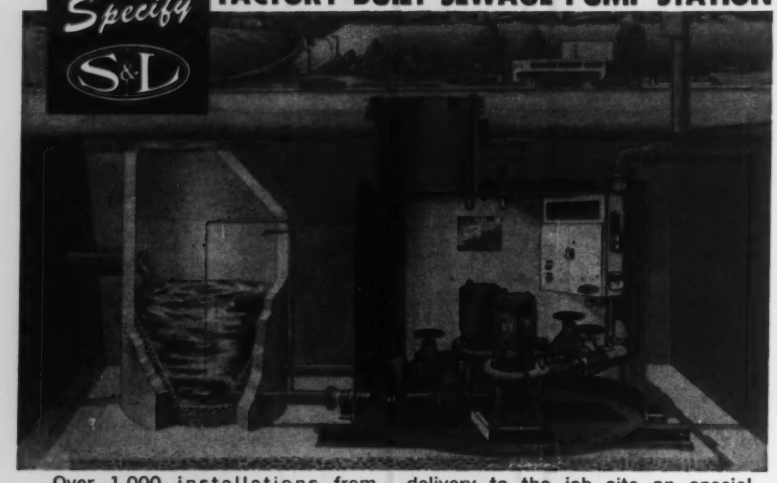
Sika Chemical Corp.—Booth #30—The company will display such products as admixtures like Plastiment, retarding densifier and Sikacrete, accelerating densifier through joint sealants, membranes and the latest in epoxy compounds.

Sonoco Products Co.—Booths #28 & #29—The company will display the following products: Sonotube Fibre Forms—used in forming round concrete columns; Sonovoid Fibre Tubes—used in forming voids in precast or cast-in-place concrete; Sonomold—concrete test cylinder mold; and P.I. Pipe—pitch impregnated pipe for use in drain systems.

Sprague & Henwood, Inc.—Booths #48 & #49—The manufacturer will emphasize "Foundation Investigation", covering both diamond core drilling and soil sampling. Other subjects which will be treated with illustrations, written material, and appropriate items of equipment are: soil sampling, pressure grouting, vane shear testing, and mud drilling.

Tubular Products, Inc.—Booth #36—Various types of concrete filled pipe and tubing columns and steel and aluminum pipe handrailing will be displayed at the Civil Engineering Show in Washington.

Specify S&L FACTORY-BUILT SEWAGE PUMP STATION



Over 1,000 installations from coast-to-coast, including Alaska and Canada prove the merit of specifying Smith & Loveless Factory-Built sewage pump stations . . . America's finest! The compact, easy-to-maintain Smith & Loveless pump station is economical, efficient and manufactured of the finest materials. It is easily and quickly installed following delivery to the job site on special Smith & Loveless trucks.

Smith & Loveless offers a complete line of lift stations with capacities from 20 GPM to 4800 GPM.

For job recommendations, complete specifications and drawings write today for our free, 100-page data manual on pump stations and pneumatic ejector lift stations. Write Department 80

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- **Best dump height and reach in its class**
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- **Fast reverse to 4.1 mph**
- **Rugged "in-line" booms and linkage**

Height with a bonus in reach. Dumps as much as a foot higher than ordinary tractor shovels . . . reaches to center of big, side-boarded trucks. Height-and-reach pays off in stockpiling, too, or loading out of excavations.

Super pry-out action. Curved-bottom bucket puts a 10¾-ton force at cutting edge. "Rolling leverage" action breaks out tough materials, gets *full* loads *fast*.

Speed with stability and control. Single-lever shift from any forward speed to either reverse. Powerful hydraulics put big loads to the top, return the bucket in a smooth, swift cycle. Positive controls . . . nearly seven feet of track . . . new "down-slope" visibility make precision work easy.

"In-line" strength. Solid steel booms and linkage are straddle-mounted on wide-spaced pivots in double-walled side frames. Cylinders operate in same line, put hydraulic power to work *straight from the shoulder*.

Ask your Allis-Chalmers dealer to set up a demonstration *now*, right on your present loading or excavating job. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

- **72 net engine hp**
- **21,000 lb**
- **1½-yd general purpose bucket**

move ahead with **ALLIS-CHALMERS**

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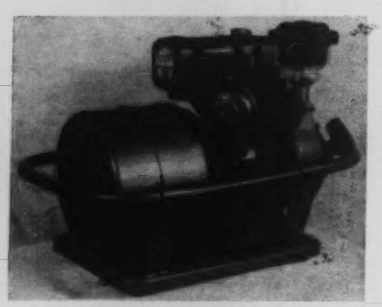
EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Semi-Brushless Light Plant

A NEW TYPE OF semi-brushless light plant which has no commutator and utilizes vertical type slip rings has recently been added to the company's line of power plants.

The generator has been designed in such a manner that all normal maintenance can be made at the open end of



No Engine-Generator Coupling Required

the generator. A small rectifier assembly which is mounted on the bearing end brace changes a portion of the AC output of the generator to DC for excitation current to the stationary field poles. This method of conversion replaces the commutator normally used with this type of light plant. The slip ring brush holder assembly is of an insulation material and is mounted on the bearing end brace. Inspection of this entire assembly is accomplished by merely prying off a stamped sheet metal cover.

Another unique feature of the pancake type generator design is that no engine-generator coupling is required. The generator armature is machined in such a manner that it fits snugly over a tapered shaft extension of the engine. It is held firmly in place, when the armature is pushed onto the shaft and by tightening a bolt in the end of the shaft. Complete generator disassembly can be accomplished in minutes with simple hand tools; a small light weight Clinton air-cooled engine with recoil starter is used for this application. **Katolight Corp., CE-9, First Ave. at Chestnut, Mankato, Minn.**

Butterfly Valves

A NEW CONCEPT IN rubber seat butterfly valves has been announced. This new line of valves (The Monoflange Mark 11) will bring a substantial improvement in economy to the high quality, high pressure rubber seat butterfly valve. It will feature numerous technical innovations and is being offered for 150 psi tight shutoff in sizes 4 in. through 20 in. A wide range of material trim and valve actuators for manual or automatic operation are available. **Henry Pratt Co., CE-9, 319 W. Van Buren St., Chicago, Ill.**

Open-Web Structurals

NEW HIGH LOAD-CARRYING capacity per pound of steel is available in open-web floor and roof framing members for spans to 120 ft. The cold-rollformed chords of the Allspan framing members have a guaranteed minimum yield strength of 47,000 psi, permitting a design stress 25% higher than that of conventional open-web structural framing, with a minimum safety factor 12% greater than that provided by other types of framing currently used, the manufacturer states.

The Allspan line is available for spans to 120 ft designed to one specification,

25% Higher Design Stress

offering for the first time short, intermediate, and long span framing members which can be chosen from a single table of allowable loads. A single table of dimensions and properties also applies to the entire line.

Tests made in conjunction with and reported by the Pittsburgh Testing Laboratory give evidence of an actual chord yield strength, obtained by cold rollforming to the V-Section, of well over 50,000 psi, substantially above the guaranteed figure of 47,000 psi. Tests were also made on V-Section specimens preheated to various temperatures and tested after cooling, and also on those tested while still at the elevated temperatures, and showed satisfactory performance under these conditions. **Macomber Incorporated, CE-9, 1926 10th St., N.E., Canton, Ohio.**

Speed-Seal Joint

ALL OF THE ADVANTAGES of factory-made compression joints for vitrified clay pipe are now available, for the first time in the Pacific Coast market, for large size pipe with the introduction of a new Speed-Seal joint, which is designed for use in all large diameter (15 in. through 42 in.) sanitary sewer line installations, the manufacturer states.

The compression feature of the new joint is accomplished by embedding a flat surface rubber gasket in a polyester casting on the interior surface of the bell. A uniform sealing surface is made by casting polyester on the spigot end of the pipe; both components are factory applied.

The joint is especially suited for installations requiring a high degree of flexibility, high standards of exfiltration and infiltration, and assured resistance to root penetration. Of paramount importance to the contractor is the time and labor the joint will save him because of its ease and speed of installation. These savings reduce his labor requirements and mean a lower in-the-ditch cost. **Gladding, McBean & Co., CE-9, 2901 Los Feliz Blvd., Los Angeles 39, Calif.**

Flame Process Speeds Remodeling Job

A DRAMATIC FLAME PROCESS known as powder-cutting is speeding a remodeling project at Huntington Memorial Hospital in Pasadena, California, by slicing through concrete walls 16-in. thick.

The highly effective process employs a mixture of iron and aluminum powder

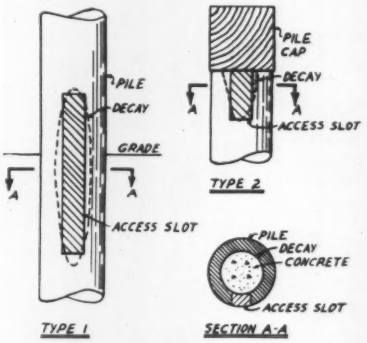
Eliminates Noise & Vibration

which is fed into a 6000-deg F oxy-acetylene flame, creating a reaction that slices quickly, cleanly, and accurately through reinforced concrete up to 18-in. thick.

Powder-cutting is ideal for hospital work, as it eliminates noise, vibration, and dust that might have endangered patients and critical instruments had conventional methods been used. **Linde Co., Division of Union Carbide Corp., CE-9, Room 2840, 420 Lexington Ave., New York 17, N. Y.**

Piling Repair Method

ON MILL CREEK BRIDGE near Bellville, Texas, about 20% of the piling were found to be hollow at the ground line. The hollow portion extended about 18 in. above ground line and 30 in. below. At the ground line, the hole was about 8 in. in diameter tapering to good wood above and below grade. The shell had been penetrated about 2 in. with the preservative treatment, and was in excellent condition.



Something had to be done to prevent the piling from "brooming". The method of repair developed takes about 1 cu ft of special concrete and two manhours labor for the average pile. Its strength is as great as the original pile and it is estimated that 10 to 15 years has been added to the life of the pile. Construction procedure is to: cut slot in piling, rout out decayed wood, treat interior with preservative, fill hole with stiff concrete, and paint surface with mastic. **Jackson Engineering, 6135 Indigo, Houston, Texas.**

Blasthole Drill

A NEW DEVELOPMENT in blasthole drilling, the 450-DR, features a Dual Rotation system which eliminates the need for conventional rifle-bar-actuated reverse rotation and adds additional power to permit faster drilling in the roughest formations.

Dual Rotation is provided by a vane type air motor, connected to the drill chuck and controlled independently of the standard rifle bar rotation. Because of its independent operation there is no hammering of the drill steels during coupling or uncoupling. Stuck steels are practically eliminated and maintenance costs are slashed on drill steels, pawls, rotation parts, and couplings.

According to the manufacturer, the new device does not sacrifice any of the standard rifle bar rotation. Instead, it adds power by supplementing the normal drilling rotation. Moreover, the company says that its four-pawl positive rotation in one direction instead of two-pawl rotation in either direction eliminates excessive pawl wear and the resulting expensive downtime. **Joy Manufacturing Co., CE-9, 233 Oliver Ave., Pittsburgh, Pa.**

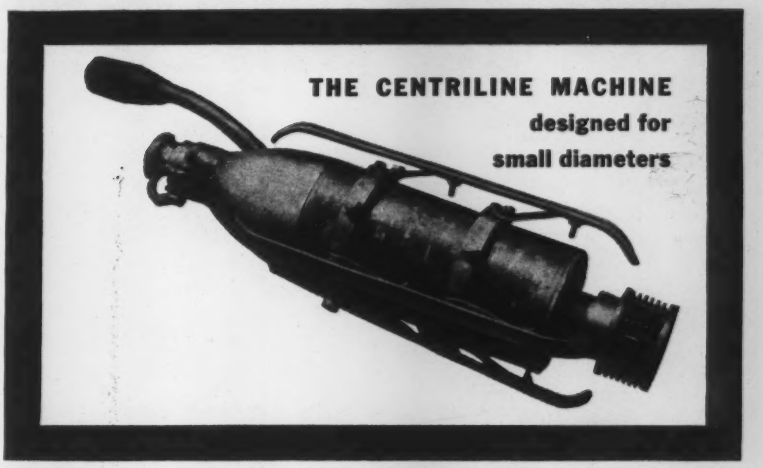
I Beam Splitting Machine

A SPECIALLY BUILT MACHINE for I Beam splitting, the Pullmax U-10 has a new automatic mechanism operated by push-button control for starting, penetrating and cutting of heavy metals.

In regular operation, the I Beam can

(*Continued on page 134*)

NOW! THE CENTRILINE PROCESS is available for 6" to 14" mains, too!



Yes, your city's small but important transmission and distribution lines can also regain their original flow capacity and pressure through the universally accepted Centriline Process of centrifugally applying a cement-mortar coating to the pipe walls. If some of your lines inadequately serve your customers' requirements, including higher demands for fire protection, investigate the numerous advantages of Centrilining your mains now.

The new, small diameter Centriline Machine eliminates most excavations at valves, laterals and corporation cocks. By eliminating these fixed costs, lengthening the distances between access openings and permitting faster lining speeds, the new Centriline Machine has really reduced the cost of lining small mains. So much so, in fact, that every water works operator should reevaluate the economics of small pipe rehabilitation.

Send today for your copy of our illustrated booklet which fully describes how Centriline can help you salvage worn out pipes from 6" to 144" in diameter permanently and for much less than you would imagine.

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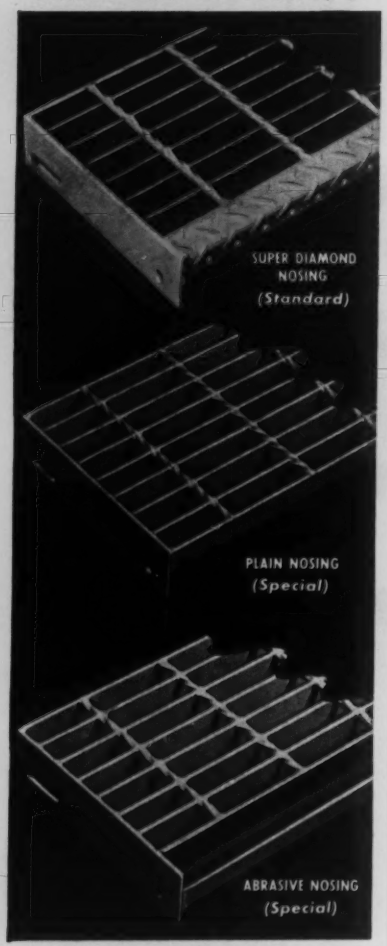

Note how spirals in cross bars alternate right and left and are slightly raised above bearing bars for an extra margin of safety.

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Nashville 2, Tennessee

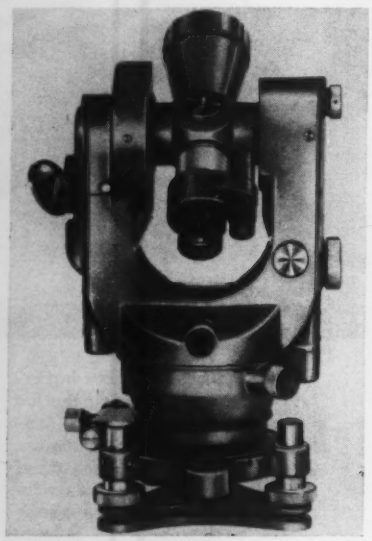
EQUIPMENT MATERIALS and METHODS

(continued)

be pulled through the machine at the rate of 10 to 20 ft per minute. The Pullmax U-10 will leave a smooth, finished edge without distortion of the I Beam. The machine can also be used for circle cutting, straight shearing and all other standard Pullmax cutting and forming operations. **American Pullmax Co., CE-9, 2455 N. Sheffield Ave., Chicago 14, Ill.**

Optical Repeating Transit

A NEW MODEL OPTICAL repeating transit which combines speed, accuracy and ease of operation, is now available. The T-1A maintains the ruggedness, simplicity and trouble-free accuracy of the time-proven T-1 plus the convenience and extra speed of automatic collimation setting.

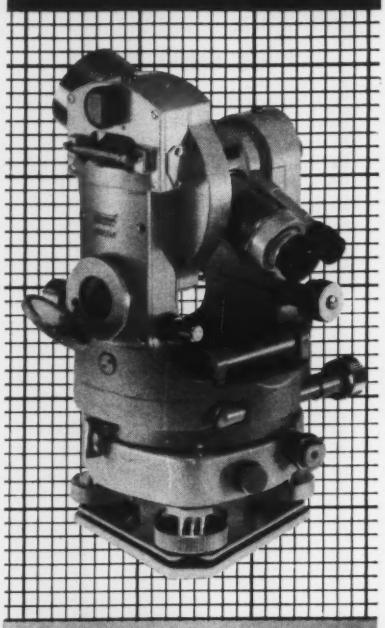


T-1A

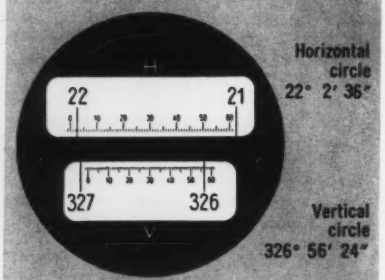
The unit increases speed and accuracy through a rapid-reading microscope mounted next to the telescope, and an internal optical micrometer which allows both circles to be read directly to within 20 sec and with easy interpolation to 10 and 5 sec between graduations on both vertical and horizontal scales.

Ease of operation and set-up of the T-1A is facilitated by an optical plummet built into the alidade, permitting the instrument to be set-up in a minimum amount of time—even on windy days—and readily checked out by rotation. **Wild Heerbrugg Instruments, CE-9, Main and Covert Sts., Port Washington, N. Y.**

Fennel
UNIVERSAL THEODOLITE FT I



Both circles can be read simultaneously
Readings direct to one minute



Easy estimation to 6 seconds—no vernier computations necessary. Easier-to-read scales and finer scale-reading hair lines than other theodolites. Built-in optical plummet. Independent conical centers. Two full sets of horizontal clamps and tangent screws, with each knob different in shape for easy differentiation by "feel." Telescope reversion bubble, standard equipment. Internal illumination available.

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50 Colfax Avenue
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New Living Space for Fort Lauderdale will rest on RAYMOND FOUNDATIONS

Architect: Charles F. McKirahan
Engineers: D. E. Britt & Associates
Contractor: Breakwater Housing Corporation
All of Fort Lauderdale, Florida

Adding to the list of impressive structures supported by Raymond Foundations is Breakwater Towers, a striking 16 story apartment building in Fort Lauderdale, Florida. When completed in 1960 it will provide housing, in a variety of apartment units, for several hundred families.

From coast to coast new apartment complexes and structures such as this are becoming a unique feature of 20th century life. And Raymond is playing an important role in this construction. For example, over half a million people currently live in buildings on Raymond foundations—and this figure is growing daily. If there's a foundation in *your* future, we'll be happy to talk to you.

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Soils Survey Instrument

A PORTABLE INSTRUMENT, the Vibroground Model 274-M quickly gives data for soil studies in connection with foundation design, road building, borrow sites, bedrock determinations, pipe line locations and similar construction work.

This instrument utilizes the Barnes Layer Method to derive through earth conductance sub-soil contour profiles which clearly indicate the locations, depth and type of soil layers. The Model 274-M is portable, weighing only 20 lb, and may be readily operated by one man who does not require technical training. **Associated Research, Inc., CE-9, 3777 W. Belmont Ave., Chicago, Ill.**

Shoe-Type Brake

NOW AVAILABLE FOR the first time on hand pallet trucks, this new, shoe-type brake is controlled by the pallet truck's steering handle and employs a lined brake shoe which acts against the steering wheels. It is available, as optional equipment, on all hand pallet trucks in the Multiton line.

Outstanding feature of the brake is its ability to slow the pallet truck gradually, or stop it instantly and smoothly. The Multiton brake operates in this positive manner, without marring floor surfaces, because its braking action is evenly applied to the truck wheels, not to the floor itself.

The new brake may be securely set as a safe parking brake while the truck is at rest; when desired, it may be completely deactivated. **Stokvis Multiton Corp., CE-9, Secatoag Ave., Port Washington, N. Y.**

Drilling Bucket

NEW TUNGSTEN CARBIDE equipped drilling bucket bores large diameter holes in hard shale, sandstone, coral and other hard formations. This special bucket has 15 tungsten carbide blocks and 18 chisel points as well as a fish tail and two chisel points on the cutter bar head. The bucket drill is rotated at a speed of about 20 rpm to cut quickly through tough subsoil formations. **Calweld, Inc., CE-9, 7222 E. Slauson Ave., Los Angeles, Calif.**

Napco Crab Tractor

AGAIN THE NAPCO CRAB TRACTOR has proved its versatility during tests in which the four wheel drive, four wheel steer tractor was used as a prime mover for tamping rollers.

Under many varied conditions, the tractor demonstrated that it is ideal for pulling many different makes of rollers. Normally pulled by a crawler tractor, a double drum 48-in. Sheepsfoot roller can be efficiently handled by the Napco Crab. This is a result of combining the

Extreme Maneuverability

tractor's four wheel drive traction with the advantages of its torque converter.

The extreme maneuverability of the tractor is a great asset when pulling tamping rollers since short turns are synonymous with saving time and thereby increasing profit.

Another advantage to the contractor, when using the tractor to pull roller attachments, is the fact that the contractor can release his more expensive crawler units for their original intended application. **Napco Industries, Inc., CE-9, 834 N. 7th St., Minneapolis 11, Minn.**

Photogrammetric Printer

ACCORDING TO THE MANUFACTURER, a new 20-deg photogrammetric printer achieves a higher degree of resolution and illumination uniformity than ever before attained in such an instrument.

By using such a unit an aircraft can take as many as five photographs simultaneously in a single pass over a target area, to the front, rear, left, and right of the aircraft at oblique angles, as well as directly downward. After correction in the printer, the oblique photographs appear as though they had been taken from directly overhead.

The printer, which can be operated by comparatively unskilled personnel, covers a full 9 x 9-in. negative format plus data area out to 10½ x 10½ in. in the negative plane. The photographic prints have a resolution of 20 lines per millimeter in all four corners of the negative frame simultaneously. **J. W. Fecker, Inc., CE-9, 6592 Hamilton Ave., Pittsburgh 6, Pa.**

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VERTICALS ARE VERSATILE, TOO: Primary water supply, sumps, pipe lines, refineries, condenser lines and boosters, circulating, dewatering, volatile fluids, cooling towers.

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A Division of the Youngstown Sheet and Tube Company
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Johnston Pump Co.
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Send complete information on industrial applications:
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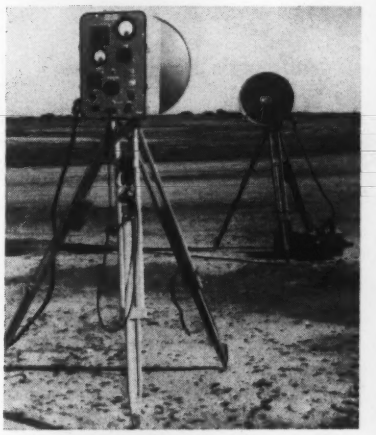
The Micro-Dist

ELECTRONIC ENGINEERING AND DESIGN innovations that provide new accuracy and easier and faster operation are offered by the Micro-Dist, the new precision electronic surveying equipment.

Micro-Dist reduces the time required to measure distances and has features that increase accuracy, permit operation under a wider range of weather conditions on an around-the-clock basis, provide easier and faster interpolation of data and introduce new operating ease.

Interchangeability of stations is one of the most unusual features designed into the instrument, which operates on the interrogator-responder principle but without the requirement of a Master-Slave



Interchangability of Stations

station set-up. Either of two stations can be operated as interogator or responder merely by throwing a switch, a feature which permits instant recheck of measurements and offers the further advantage of covering a greater number of points faster with fewer instruments. Once a measurement is taken, either station may be moved to a new point for the next measurement, thereby increasing the flexibility of the system.

The direct readout feature is another new advance, with the operator merely reading a digitized measurement on a front-panel meter—a new readout that is easy to see and easy to record, minimizing chances of operator error. **Cubic Corp., CE-9, 5575 Kearny Villa Road, San Diego 11, Calif.**

Curtain Wall Sealer

A NEW HIGH PERFORMANCE curtain wall and building maintenance sealer, off-white in color, and especially designed to blend with light colored masonry materials such as marble, limestone and concrete is now available.

When mixed with a curing agent, this sealer chemically cures in place to produce a solid rubber seal which possesses excellent flexibility, aging and non-flow qualities. **Minnesota Mining & Mfg. Co., CE-9, 900 Bush Ave., St. Paul 6, Minn.**

Four-Wheel Pipe Cutters

EASY PORTABILITY, FAST one-man operation and clean, accurate cuts are features claimed for a line of new rotary four-wheel pipe cutters designed for large steel and cast iron pipe from 12 in. to 24

(*Continued on page 138*)

for a wise investment specify a NATIONAL pool . . .

• a life-time pool investment . . . durable as a wall of rock . . . assembled quickly and at lower cost with National's unique prestressed interlocking concrete units into a triple wall capable of withstanding the severest temperature and other stresses . . .

• a trouble-free pool installation . . . sparkling as a mountain brook . . . operated continuously with fully automatic National controls and equipment that assure the lowest possible operating expense . . .

. . . NATIONAL pools . . . specified by architects and engineers for America's finest country club, community, hotel, school and military pools . . . widely approved by State Boards of Health . . . produced in a wide range of sizes and shapes to meet your needs . . . fully equipped as required with all filters, heaters, underwater lights, skimmers, chlorinators, fittings, vacuum cleaners, ladders, diving boards, safety equipment and other accessories . . .

the services of our specialized and experienced engineering staff are available to you upon request . . .

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P.O. Box 1101, Indianapolis, Ind.
Please send information on National Prestressed Pools
I am interested in: ☐ BUILDING A POOL ☐ FRANCHISE ☐ EQUIPMENT ☐ FILTERS
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CE

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Figures prove that the dollars ($) spent in the maintenance (m) over a period of years (yr) in many cases are much greater than permanent improvement with the strength, durability and economy of USF

BRIDGE FLOORING

FOR BRIDGES, OVERPASSES, VIADUCTS, ETC.

Complete details for building or rejuvenating are available by writing...

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WOOSTER, OHIO

Highway Guard Rail • Bridge Flooring
Steel Forms for Concrete Bridge Decks
Corrugated Metal Pipe • Window Wells
Metal Doors & Frames • Metal Buildings

EQUIPMENT MATERIALS and METHODS

(continued)

in. diameters.

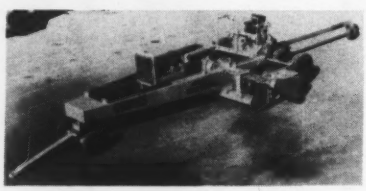
The new device consists of a separable circular frame joined at the mid-sections by hinged screws and adjusting nuts. An aluminum handle is placed successively over the eight lugs on the outside of the frame and the same handle is used to tighten the cutter as cutting proceeds.

The cutter is said to be especially suited to pipeline maintenance and repair. The 16-in. size weighs only 51 lb complete and all of the units separate into three easily carried parts. A minimum of digging is required since the four-wheel design requires no more than 45 deg to 60 deg of handle swing, and only a 6 to 8-in. channel is needed under the pipe. **Reed Mfg. Co., CE-9, Wright Bldg., Erie, Pa.**

Automatic Road Builder

A NEW IDEA IN roadbuilding equipment has been announced. The Automatic Road Builder—Garb, for short—handles virtually every blading job from the scraper to the paver.

As the carry-type scraper replaced dozers and trucks on many large volume earth moving jobs, so does the Garb replace many blade machines on spreading, rough grading and finish grading operations.



Handles Every Blading Job

Grade is maintained from a patented automatic 44-ft wheelbase, and cross-slope is held by a patented fully-hydraulic automatic pendulum control. The machine has a 13-ft blade, 10-cu yd bowl capacity and weighs approximately 28,000 lb. It has a 20-in. dia conveyor screw set laterally in the bowl for balancing the load in the bowl in spreading operations or for side casting into a windrow. **Gurries Manufacturing Co., CE-9, 1720 South First St., San Jose 12, Calif.**

Lockbolt Gun

A NEW LIGHTWEIGHT, more powerful pulling tool, designated as the Cherry

(*Continued on page 139*)

(continued)

G-87 Lockbolt Gun, has been developed. It is designed to install lockbolts with pull-in and setting loads that exceed the capacity of other pneumatic lockbolt guns on the market, the manufacturer states.

Although weighing only 10½ lb, it is a short stroke, high pin break tool that develops up to 11,000 lb of pull at 100 psi air pressure. The G-87 can be used at pressures up to 125 psi with a corresponding increase in pulling power without damaging the gun.

The gun installs all lockbolts from 3/16 in. through 3/8 in. dia, including the five-groove high break load pin in all materials. Pulling nose assemblies currently used with other pneumatic lockbolt guns fit the G-87. **Townsend Co., Cherry Rivet Div., CE-9, Box 2157-Z, Santa Ana, Calif.**

Retractable Wheel Tandem Roller

SUPPLIED WITH ROLL-O-MATIC drive, the new 4-6 ton retractable wheel tandem roller is designed to work faster, operate easier, roll to closer clearance, and transport more quickly than ever before. This portable roller is said to be built like the company's big Roll-O-Matic tandem rollers, with all their operating advantages, but this one with its retractable wheels can go quickly from one location to another and be ready to work the moment it gets on the job.

Roll-O-Matic Drive

Roll-O-Matic drive is a highly efficient combination of torque converter, automatic fluid transmission, and tail-shaft governor, by means of which the rolling power is automatically increased or decreased as needed.

The company claims that more than twice the needed power is available, that fuel consumption is reduced up to 25%, that engine life is increased up to 35%, that life of forward-reverse clutches is increased 40 to 50%, and that 10% more surface can be rolled and more jobs reached per day. **The Galion Iron Works & Mfg. Co., CE-9, Galion, Ohio.**

New Joist Hanger

THE DEVELOPMENT OF A NEW, formed seat joist hanger to add to the company's present Strong-Tie construction accessories line has been announced. The new joist hangers have excellent vertical and torsional load capacities, up to 3,200 lb ultimate. Hangers are formed of 18-gauge, heavily coated galvanized steel. Seat, sides and top-bend are work-hardened under 120,000 lb pressure to provide remarkable holding power and resistance to torsional stress.

The joist hangers are available in single or double (saddle) types for standard surfaced lumber (s4s) in sizes to fit 2 in. x 4 in. up to 2 in. x 14 in. joists. **Simpson Co., CE-9, 1060 E. 11th St., Oakland 6, Calif.**

designed WITH CONCRETE IN MIND

GAR-BRO POWER-CARTS *move concrete faster!*

SAVE SECONDS *in each operation*

In any construction race, the Power-cart accelerates faster . . . dumps faster . . . turns in smaller radius . . . and can be reversed at top speed.

SAVE MINUTES *each round trip*

The ability to save seconds in each operation—loading, traveling and dumping—adds up to substantial time savings.

SAVE HOURS *of productive time*

Faster trips mean more trips per hour and more concrete delivered to the form because the Power-cart delivers a full 12 cu. ft. load.

Moving concrete faster at a low cost is the purpose of the Gar-Bro Power-cart. That is why it is the *fastest* and, at the same time, the lowest priced motorized concrete cart on the market. It is lowest in operating cost and lowest in maintenance cost as well.

Let your Gar-Bro dealer demonstrate why Gar-Bro Power-carts are best. Phone him today or write for catalog.

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General Offices: 2415 East Washington Blvd., Los Angeles 21, Calif.

GAR-BRO CONCRETE HANDLING EQUIPMENT

THE WORLD'S MOST COMPLETE LINE

New Applications for Metal Containers

THE STANDARD TYPE of metal shipping container, known to the transportation industry as Jetapak, has been used by Berlanti Construction Co. of New Jersey as a means of storage for explosives.

The container meets legal requirements concerning storage of explosives by a simple modification; it is lined on the inside with 2-in. planking. A further modification added lock and baffle protection for the padlocks.

Berlanti found that these containers could also be used for open-field storage of instruments and equipment. **Jeta, Inc., CE-9, 949 Saw Mill River Rd., Yonkers, N. Y.**

Pneumatic Conveying Equipment

A NEW LINE OF pneumatic conveying equipment for handling bulk cement and other free-flowing materials has been announced.

Greatly Reduced Maintenance

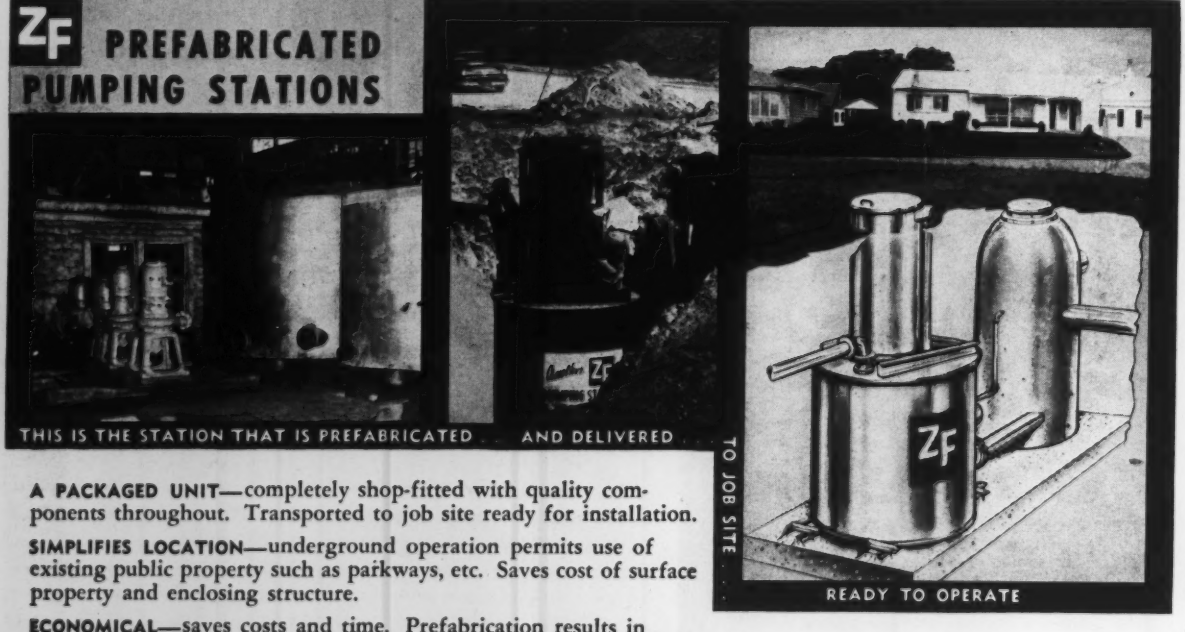
Pneumatic bulk handling systems drastically cut the initial cost of new plant construction, with the need for cement elevators and/or screw conveyors eliminated and continued savings are achieved through greatly reduced maintenance.

To convert an existing plant, the company's engineers will design and construct from standard component parts a complete pneumatic bulk handling system, which will transfer cement or other free-flowing materials faster and more efficiently than present equipment can do the job. **Engineered Equipment, Inc., CE-9, Waterloo, Iowa.**

Wall Chart of Conversion Factors

A REFERENCE TABLE FOR engineers and other executives in wall chart form has been published. Included are common conversions such as inches to centimeters or watts to hp as well as many conversions that are difficult to locate in reference manuals. Some examples are atmospheres to kgs/sq cm and cm/sec to miles/hr, **Precision Equipment Co, CE-9, 4411 E. Ravenswood Ave., Chicago 40, Ill.**

ZF PREFABRICATED PUMPING STATIONS



A PACKAGED UNIT—completely shop-fitted with quality components throughout. Transported to job site ready for installation.

SIMPLIFIES LOCATION—underground operation permits use of existing public property such as parkways, etc. Saves cost of surface property and enclosing structure.

ECONOMICAL—saves costs and time. Prefabrication results in lower construction costs and less time at job site. Simply set in place, connect and start up.

COMPLETE DATA, SPECIFICATIONS AND DRAWINGS AVAILABLE—WRITE

ZF ZIMMER & FRANCESCON P.O. BOX 359, MOLINE, ILLINOIS

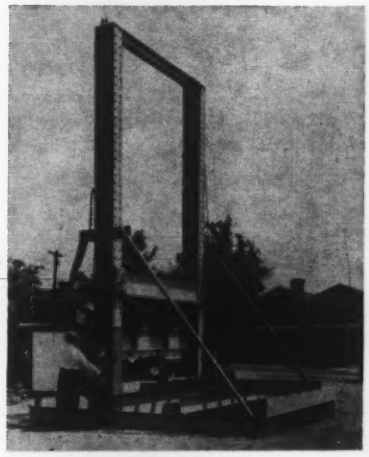
EQUIPMENT, MATERIALS and METHODS

(continued)

Pipe Testing Machine

DESIGNED TO ACCOMMODATE PIPE in 8 ft lengths up to 144 in. dia, the frame of the Model PT-250 Pipe Testing Machine can be extended in width to accommodate pipe in 16 ft lengths.

It is equipped with two 8-in. dia hydraulic rams with a working stroke of 10 in.; it has a loading capacity of 500,000 lb. The load indicator is 16 in. dia and shock proof mounted in a steel lock box



Model PT-250

along with the pump assembly which consists of a two-stage manual pump and a constant flow electric pump with a widely variable rate of loading. The pumps can be operated separately or simultaneously.

Pressure beams are spring counterbalanced so that their weight will not affect the gage reading, and are movable vertically by means of a heavy worm gear winch and an arrangement of pulleys. **Forney's Incorporated, Tester Div., CE-9, P. O. Box 310, New Castle, Pa.**

Horizontal Auger

CAPABLE OF BORING THROUGH solid rock formations and installing pipe up to 48 in. in diameter as it bores, a horizontal auger has been introduced to the pipeline construction industry and public utilities. It has attracted interest of spreadmen throughout the country because of its time-saving on pipe installations under roadways and railroad rights-of-way.

Designed to bore and line holes up to 48 in. in diameter and 125 ft in length, the machine is powered by a 73 hp engine with direct gear drive and hydraulic feed; it weighs about 9500 lb.

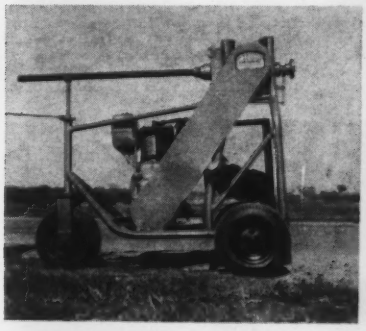
The auger has a special patented curing head, consisting of a series of sawteeth with carbon steel tips, turning in a clockwise direction as it cuts its way through rock and earth. **Compton, Inc., CE-9, 1954 Monticello, Clarksburg, West Virginia.**

Portable Auger Drill

A NEW, IMPROVED PORTABLE auger drill which is capable of drilling a hole a minute in average soil has been placed on the market.

Called the Portable Auger Drill, it weighs only 525 lb and has pneumatic tires and timken bearing equipped wheels for easy moving from job to job. The feed screw and auger fold over during transportation, allowing the user to get under low obstructions with the unit.

It is small in size but will bore holes 4 to 12 in. in diameter and up to 40 in. deep in most soils. It is designed so that weight transfers to or from the auger



Weighs Only 525 Lb

cutter instantaneously with complete safety to the operator.

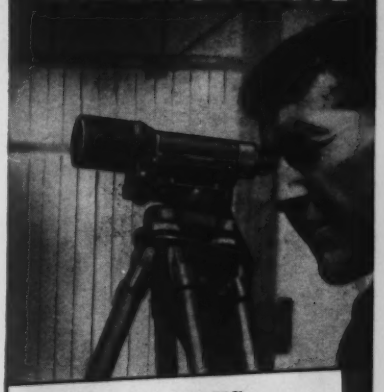
Welded tubular framework reduces vibration during drilling and the tilting digger makes it possible to drill vertical holes on slopes, hillsides and uneven ground. One man can accomplish all drilling operations unassisted by means of simple, convenient control levers. The coupling on the feed screw is adapted for all auger sizes and different diameter augers can be put on and taken off in a minimum of time. **J. R. Prewitt & Sons, Dept. R., CE-9, Pleasant Hill, Missouri.**

Free-Piston Pump

WITH ONLY 9 MOVING PARTS, the Free-Piston Pump will pump everything from molten metals to ice cream, including slurry, distilled spirits, milk, concrete, medicines, syrups, sludge, plastics, acids

(*Continued on page 142*)

WHERE THERE'S A
BIG JOB
THERE IS A
KERN
INSTRUMENT



WORLD FAMOUS
precision surveying instruments... compact, rugged construction... fast, effortless operation. More reliable results in less time.

KERN'S NK3
precise level
Was used at Gloucester Anchorage of new Walt Whitman Bridge then under construction over Delaware River (Modjeski & Masters, Ammann & Whitney, Consultants to the Delaware Bridge Authority of Pa. and N. J.)

DESIGNED FOR HIGHEST PRECISION LEVELING

- Functional, down-to-fundamentals design—only 4½ lbs. (8 lbs. with carrying case).
- Coincidence level and fine tilt screw.
- Readings at a glance—level and rod may be read simultaneously through 30x Telescope.
- Mean leveling accuracy under normal conditions ± .008 ft. per mile.
- Kern AR coated optics produce substantial increase in brilliance and contrast of image.

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PROMPT, RELIABLE SERVICE
FACTORY TRAINED PERSONNEL
Kern and Only Kern Offers You the Latest Designs of Dr. Henry Wild

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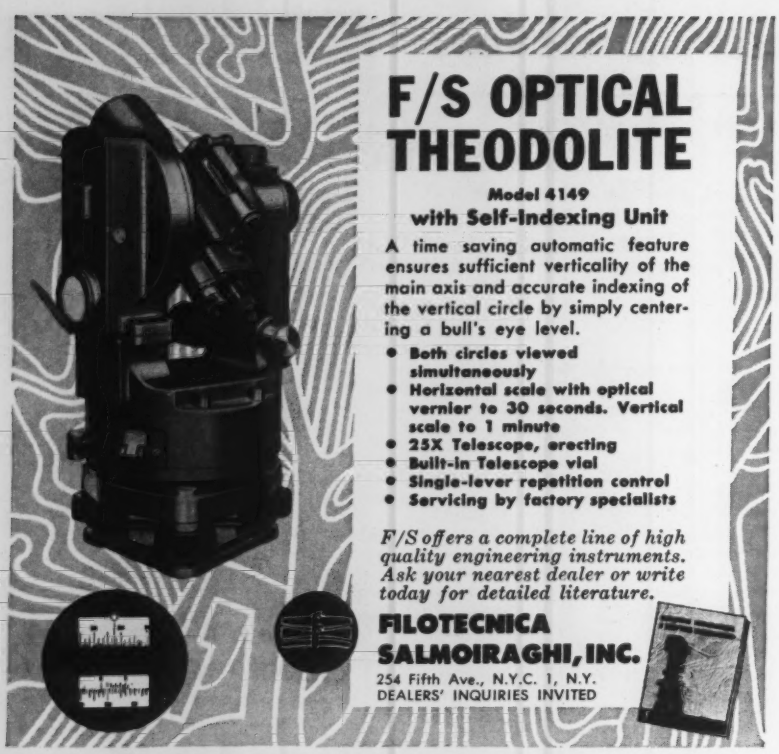
The FINEST in SURVEYING EQUIPMENT
KERN INSTRUMENTS INC.
120 Grand St., White Plains, N.Y.


F/S OPTICAL THEODOLITE
Model 4149
with Self-Indexing Unit
A time saving automatic feature ensures sufficient verticality of the main axis and accurate indexing of the vertical circle by simply centering a bull's eye level.
• Both circles viewed simultaneously
• Horizontal scale with optical vernier to 30 seconds. Vertical scale to 1 minute
• 25X Telescope, erecting
• Built-in Telescope vial
• Single-lever repetition control
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F/S offers a complete line of high quality engineering instruments. Ask your nearest dealer or write today for detailed literature.
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DEALERS' INQUIRIES INVITED

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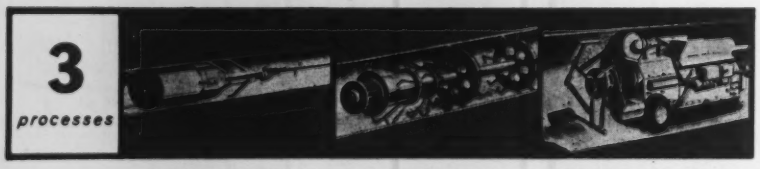
REHABILITATE
OLD, CORRODED OR LEAKY PIPE LINES



THE TATE PROCESS is for pipe diameters from 4" to 16" and is done, "in place," after by-pass lines are set up to carry on with water service.

First, the pipe is scraped and cleaned. Then, cement mortar is fed in and applied under pressure to a compact thickness of 3/16" to 1/4" giving the final effect of one continuous, cement mortar lined tube.

THE SPUNLINE PROCESS is partly TATE and partly centrifugal, developed to provide a thin lining for preventing corrosion and to restore hydraulic flow, particularly in cast iron pipe. The cement mortar lining can go through bends and past openings. It can be applied "in place." Uninterrupted continuity is obtained.

CENTRILINE Centrifugal Process. Cement mortar lining ingredients are mixed to rigid requirements and applied under a high velocity spray with uniform speed. Rotating steel trowels spread the mortar to a smooth, hard finish. Pipe sizes vary from 16" on up to 144". Clay, cement, brick, steel, cast iron and wrought iron pipes may be CENTRILINED.

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DIVISION OF AMERICAN PIPE & CONSTRUCTION CO.

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Rail Address: Pacific Electric, Watson, California

EQUIPMENT MATERIALS and METHODS

(continued)

and semi-solids, in 100% stainless steel non-contaminating chambers.

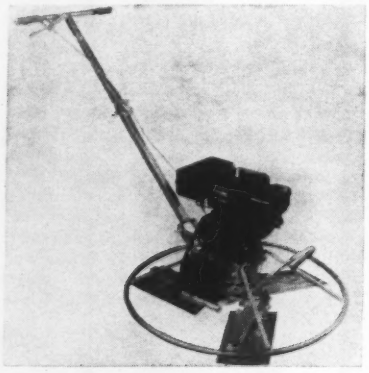
The pump impels a continuous air-free flow without pulsating or surging. It requires no safety or relief valves; when a stoppage occurs, the pump stops. It can be operated with complete safety and efficiency submerged, or under any condition. **Crossley Machine Co., CE-9, Mammoth & Bell Sts., Trenton, N. J.**

Power Trowel

THREE NEW LABOR-SAVING devices have been added to make the 24-in. Master Midget power trowel safer, easier to use and handle.

One of these devices is a blade adjusting switch, located about half-way up the handle where it can be conveniently reached by the operator while the machine is running. A flip of the switch raises the blades for finishing or lowers them for floating.

Also added is a spring loaded throttle and "dead man" control. Located at the operator's fingertips, it puts complete control of the unit's speed in his hands at all times. When released, it automatically



Blade Adjusting Switch

idles the 1.6 hp Briggs and Stratton engine and keeps the machine from getting away from the operator.

The Midget has three combination blades that adjust easily for float, sweat, smooth or hard finishes and produces a hand-trowel sweep finish. Weighing only 70 lb, this gas-powered, portable trowel is used on smaller construction jobs—in basements, in and around pipes, walls and other obstructions where hand finishing was required in the past. **Master Vibrator Co., CE-9, 463 Stanley Ave., Dayton 1, Ohio.**

CONCRETE TESTERS

The World's Finest Low-Cost Precision Testers

For

CYLINDERS
CUBES
BLOCKS
BEAMS
PIPE

IF IT'S A CONCRETE TESTER YOU NEED-GET IN TOUCH WITH

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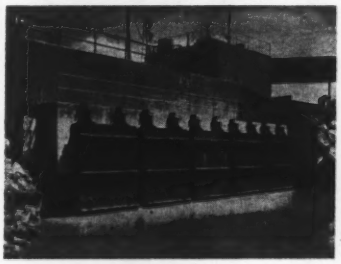
TIDE GATES



Five
12′ High x 9′ Wide
Type MMT Tide Gates
on Shockoe Creek,
Richmond, Va.

Engineers—
GREELEY & HANSEN
CHICAGO, ILL.

Contractor—
H. G. BOWLES
RICHMOND, VA.

BROWN & BROWN
LIMA, OHIO, U.S.A.

Literature Available

KURE-N-SEAL—A 4-page brochure, containing application and test data on Kure-N-Seal, for curing, sealing and dustproofing newly-poured concrete surfaces in one operation, is now available. A blend of synthetic rubber resins in fast evaporating solvents, which produces a transparent, hard glossy film to protect the floor from traffic abrasion, water spillage, mild acids and alkalies, Kure-N-Seal is applied to freshly laid concrete to promote water retention and complete hydration of the cement. **L. Sonneborn Sons, Inc., CE-9, 404 Fourth Ave., New York 16, N. Y.**

TRACTOR CATALOG—This 24-page catalog on the Model TC-12 Twin Power Crawler Tractor is well illustrated with photographs from various types of operations, cutaway and sectional views, and drawings that explain twin-power application, Torqmatic Drive, hydraulic track tensioning and other design features of the tractor. The catalog contains condensed specifications and performance chart in addition to data on attachments that are available for use with single and double cable control units. **Euclid Div., General Motors Corp., CE-9, 1375 Chardon Rd., Euclid P. O., Cleveland, Ohio.**

WORM GEAR SETS—A new catalog that provides basic data needed for accurate selection of worm gear sets has been published. The 24-page bulletin, fully illustrated with explanatory drawings, contains basic information on worm gearing as well as selection data. Opening sections provide design data and information on the special features of worm gearing, how to select it, and how to calculate bearing loads. **De Laval Steam Turbine Co., CE-9, 852 Nottingham Way, Trenton 2, N. J.**

NON-SHRINK MORTAR—How to achieve better results in 12 important construction operations by using non-shrink mortar is highlighted in this 4-page publication. The operations are illustrated in a building cross section view and cover water-proofing walls and joints, grouting building columns, machinery and anchor bolts, caulking sewer pipe joints, patching defects in concrete, and setting floor brick and quarry tile. **The Master Builders Co., CE-9, Euclid and Thomas Aves., Cleveland 3, Ohio.**

CONSTRUCTION EQUIPMENT—Literature is now available on utility bridges, subgrade testers, sub-grader planers, automatic spray curing equipment, and the D.C. Gas Electric Concrete Finisher. Photographs, brief descriptions and specifications are included. **Flexible Road Joint Machine Co., CE-9, Warren, Ohio.**

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HYDRAULIC DREDGING

GAHAGAN

a leading name for over 50 years

Gahagan Dredging Corporation, 90 Broad Street, New York 4, N.Y. Write, wire, or phone Whitehall 3-2558. Cable "Walgahagan".

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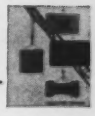
POUR CONCRETE
these catalogs are for you...
just check those desired

☐ Catalog featuring EFCO Steel Forms available on a purchase basis.

☐ Catalog featuring Economy Steel Forms available on a rental basis.



☐ Catalog featuring EFCO Steel Forms, Economy Steel Forms and Special Economy Steel Forms.

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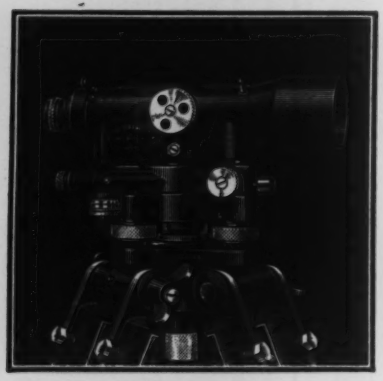

PROVEN IN THE FIELD . . . WHERE PERFORMANCE COUNTS

Watts Microptic Engineers' Levels are tops with foremost construction engineers throughout the country. Here is precision performance, time-saving performance, dependable performance in all climates and terrain. For full information on the complete line of Watts Microptic Engineers' Levels see your nearby Dietzgen Dealer. Made by Hilger & Watts, Ltd., London, sold and serviced in the United States by the Eugene Dietzgen Co.

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DIETZGEN

Literature Available

Forged-Traks—A comprehensive 12-page booklet fully describes the Forged-Traks demonstrating their ability to operate where rubber-tired equipment cannot travel. Diagrams reveal how the Traks provide absolute stability due to their low center of gravity, eliminating side-slip with their long straight-edges, and giving the flotation of *32* 10:10 x 20 tires. Pictures show types of Trak-mounted equipment and illustrate advantages in construction, oil fields, pipe lines, logging and mining. **Athey Products Corp., CE-9, 5631 West 65th St., Chicago 38, Ill.**

Weytex Hardboards—Product styling with Weytex hardboards is the subject of a newly developed brochure. The machining and working characteristics of the hardboards in industrial use are fully covered. Techniques for sawing, die-cutting, punching, drilling, and routing and shaping with either wood or metal working machinery in volume production are described and illustrated. Finishing, laminating and fastening methods complete this new guide. **Silvatek Products Div., Weyerhaeuser Timber Co., CE-9, Tacoma, Wash.**

Steel Swimming Pool—A new 4-page brochure which illustrates and describes the complete line of all-steel swimming pools has been made available. The company applies the modular principle in the design and construction of its steel pools. The modular sections, which permit a wide variety of styles are welded together to form the complete pool in the desired size and shape including rectangular, L-shaped, T-shaped and special shapes. The flexibility of the modular design also makes it possible to economically expand the pool when desired. **Hammond Iron Works, Swimming Pool Div., CE-9, Warren, Pa.**

Rotary Gun Drilling Machines—A new two-color, 8-page bulletin including 13 illustrations describing a complete line of rotary gun drilling machines, has been released. The booklet describes the Franks-Speedstar 30-AW rotary drilling machine, a medium weight, combination gun, conventional air and water rotary drill; the model 40-BH, designed primarily as a blast hole machine incorporating the features required for a rugged, well constructed drill for the mining and construction industry; and the 50-AW, a power-take-off rotary drill engineered and produced to create a drilling machine for all waterwell contractors requiring versatility, huskiness and mobility. **Stardrill-Keystone Co., CE-9, 1210 Kenton St., Springfield, Ohio.**

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From the MANUFACTURERS

APPOINTS PUBLIC RELATIONS AGENCY: Richard S. Smith & Associates, Chicago public relations agency, has been appointed to conduct a public relations program for Soiltest, Inc., Chicago, a leading manufacturer of engineering test apparatus for soils, concrete, asphalt, and similar materials . . . **BENDIX MOVES OFFICE:** The Bendix Computer Division's District Sales Office serving the San Francisco Bay area and the Northwest, has moved to expanded quarters in downtown Oakland at 1330 Broadway, Suite 1121 . . . **SUBSIDIARY COMPANY FORMED:** Chicago Bridge & Iron Co., Chicago, and G. & J. Weir Limited of Glasgow, Scotland, have announced the formation of Weir-Chicago Bridge, a jointly owned subsidiary company, which will design, fabricate and erect saline water conversion plants. The Company will combine the experience of G. &. J. Weir, a leader in large salt water evaporators, with the fabrication and construction facilities of C B & I . . . **MERGER ANNOUNCED:** The merger of Dennison Sewer Pipe Corp., Junction City Clay Co., and the Stillwater Clay Products Co. of Cleveland, Ohio, has been disclosed. The transaction involves all facilities and assets of Dennison, Junction City and Stillwater, including plants at Dennison, Junction City and Uhrichsville, Ohio . . . **NEW PRODUCTS DEPARTMENT:** Keasbey & Mattison Co., Ambler, Pa., discloses the formation of a new products department designed to carry new products along from the idea stage to the marketing stage . . . **WAREHOUSE OPENING:** The Alumiline Corp. of Pawtucket, Rhode Island, announces the opening of a warehouse in Hicksville, Long Island, for faster deliveries to the metropolitan New York, New Jersey and Pennsylvania areas. A complete inventory is being maintained at this warehouse including stock doors and frames, store front moldings, architectural shapes and alumilited sheets . . . **OPEN NEW OFFICES:** Dorr-Oliver Inc. announces the opening of a new sanitary sales office in Winter Park, Florida. Centrally situated, the office will enable the company to provide better service for consulting engineers in Florida and the southern counties of Georgia, areas formerly served directly from D-O Southeastern Sanitary Division headquarters in Atlanta, Georgia . . . The opening of new sales and engineering offices at Los Angeles and San Francisco, is announced by the Lunkenheimer Co. of Cincinnati, Ohio, manufacturer of quality valves and engineering devices . . . **SALES AGENT APPOINTED:** Walker & LaBerge Co., Norfolk, Va., has been appointed exclusive building product sales agent for the Building Products Division of The R. C. Mahon Co., Detroit . . . **ESTABLISHES INDUSTRIAL DIVISION:** Moog Servocontrols, Inc. announces the establishment of an Industrial Division, which will be responsible for the development of Moog's industrial product line and all non-military product marketing activities and will formally extend the company's activities into the commercial field . . . **NEW BUILDING:** The A. C. Horn Companies Division of Sun Chemical Corp. announces the completion of the latest addition to the company's facilities located on a 5½ acre site at Bell Gardens, Los Angeles, Calif. A modern concrete building totaling 6,000 sq ft, it will house the Southern California sales administrative staff which also serves Arizona . . . **ENTIRE OPERATIONS PURCHASED:** The purchase of the entire operations for distributing Spanall products in the Western Hemisphere from the Universal Builders Supply Co., Inc., of New York City has been announced by Chain Belt Co., Milwaukee . . . **DISTRIBUTOR AGREEMENT:** The Ohio Injector Co. and Jones & Laughlin Supply Div. have announced a distribution agreement for OIC valves throughout the United States . . . **NEW COMPANY FORMED:** Voss Belting & Specialty Co., Chicago, announces the formation of Voss Engineering, Inc., which will specialize in the manufacture and distribution of vibration and shock controls for machinery, bridges and structures . . . **WESTINGHOUSE SPENDING $25 MILLION:** Westinghouse Electric Corp. has announced that it will spend more than $25 million to expand and modernize facilities for the manufacture of turbines, generators, large motors and related heavy apparatus at plants in Lester, Pa., East Pittsburgh, and Sunnyvale, Calif.

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PROCEEDINGS AVAILABLE

July

Journals: Air Transport, Engineering Mechanics, Hydraulics, Sanitary Engineering.

2111. The Future of Airline Ground Transportation, by William J. Culbirth, Jr. (AT) The capable ground operator currently operating the surface transportation at our various Airports is a "key" man to the success of the jet age.

2112. Airport Revenue Bond Financing, by Walter C. Cleave. (AT) To reduce financing costs and encourage efficient operation, it has been suggested that airports owned by a city or other public body be combined into a single airport system.

2113. An Operator's Experience in Airport Operations with Jets, by R. J. Sutherland. (AT) This paper outlines experiences at various airports during the initial four months of operation with Boeing 707-123 model jet air transports.

2114. Experience in Airport Operations with Jet Aircraft, by Peter W. Ball. (AT) BOAC has successfully operated Jet and Turbo-Prop Aircraft with little difficulty or inconvenience to others.

2115. Experiences in Air Terminal Operations with Jet Aircraft, by Randall W. Kirk. (AT) Air terminal operating experience during the first seven months of Boeing 707 is recounted with specific reference to Idlewild (New York), Le Bourget (Paris), Ciampino (Rome), and London Airport-North (England). Criteria are included for design of the ideal airport terminal.

2116. Airline Experience in Airport Operation with Jet Aircraft, by Marci B. Fannon. (AT) One important facet of jet integration concerns interim facilities until planned terminals and facilities become available. Improvements in general airport arrangement—ramp layout, passenger handling facilities, airplane servicing and over-all operation—all assist in providing faster, more efficient ground handling, with improved service and comfort for the passenger.

2117. The Development of Design Criteria for Washington International Airport Terminal Facilities, by Richard M. Huber. (AT) Design concepts, Progress Report, and special features for aircraft and passenger handling are being incorporated in the New Washington International Airport under construction near Chantilly, Virginia.

2118. Development of Rigid Pavement Design Criteria for Military Airfields, by James P. Sale and Ronald L. Hutchinson. (AT) Results of Corps of Engineers' rigid airfield pavement investigations since 1940 are related to the continuing changes in requirements dictated by military aircraft growth and increasingly severe ground operational characteristics. Traffic test data is integrated into usable design and construction criteria.

2119. Prestressed Concrete Pavements, by Eric C. Molke. (AT) Deflections and bending moments for beam and slab on elastic foundation are reviewed for the elastic as well as the plastic range. Advantages of working in the plastic range for slab moments confirm the usefulness of prestressing to harmlessly close small haircracks.

2120. Effects of Jet Fuel Spillage and Blast on Pavements, by H. J. Lichtefeld. (AT) This paper reviews the problems associated with jet fuel spillage, heat and blast created by the operation of turbine-powered aircraft as related to civil airport pavements. The material is compiled from information obtained from the military, aircraft manufacturers, and aircraft engine manufacturers, as well as from observations at several civil airports.

2121. Runway Lighting—New York International Airport, by John P. Veerling. (AT) A description is given of lighting under construction for a new instrument runway.

2122. Approach and Runway Lighting as Viewed by the Air Line Pilot, by Harold R. Miller. (AT) The experiences of a pilot in making landings in a jet aircraft are presented. The visual aids necessary to the making of a successful landing are described.

2123. The Airport Operator in the Jet Age, by E. Thomas Burnard. (AT) Capital financing, master planning, keeping abreast of technological developments in aviation and achieving financial self-sufficiency are among the key problems of airport operators in the Jet Age.

2124. Runway Lengths for Jet Transports, by Robert Horonjeff and Richard Coykendall. (AT) Planning of runway lengths requires familiarity with airplane characteristics and performance regulations. Lengths required by a specific aircraft vary considerably. The influence of technical factors significant in determining runway lengths needed by jet transports is illustrated or explained.

2125. Paris-Orly Airport and its New Terminal Area, by Henri Vicariot. (AT) The Orly Master Plan results in fewer runways and more space for commercial and industrial areas. A new terminal is under construction, which will provide facilities for international and domestic flights.

August

Journals: Hydraulics, Power, Soil Mechanics and Foundations.

2126. Translation of Foreign Literature on Hydraulics: Progress Report of the Task Force on List of Translations of the Committee on Hydromechanics of the Hydraulics Division. (HY) In 1958,

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the Committee on Hydromechanics established a Task Force on List of Translations, for the purpose of bringing and keeping the original List of Translations of Foreign Literature on Hydraulics, Manual No. 35, up to date. The first addendum to this manual is presented in this paper.

2127. Operation of Spillways in Northwest Projects, by R. B. Cochrane. (HY) Large tainter gates have advantages over the vertical-lift type of gates for spillways. Stilling basins of such spillways, which are subject to year round use, should be designed with ample proportions to permit latitude in operation procedures and to minimize maintenance costs.

2128. Consistency in Unitgraphs, by Bertram S. Barnes. (HY) This paper undertakes a re-appraisal of certain common assumptions and presents a rapid and positive arithmetical method of deriving unitgraphs from compound hydrographs. An urgent need for more study of lag relationships is demonstrated.

2129. Spillway Design for Pacific Northwest Projects, by Marvin J. Webster. (PO) This paper summarizes the design criteria and characteristics for spillways in five Pacific Northwest Projects which include Chief Joseph McNary, The Dalles, Detroit, and Cougar Dams. The spillway crests for Chief Joseph and The Dalles are under-designed to seventy-five percent of the maximum heads. Model studies were used extensively in the design of four of the five spillways described in the paper.

2130. USBR Practices for Control of Cracking in Arch Dams, by Charles L. Townsend. (PO) This paper describes the temperature control studies undertaken by the Bureau of Reclamation and the temperature control measures most commonly used to prevent cracking in arch dams.

2131. The Thomas H. Allen Electric Generating Station, by Peter J. McCoy and Vincent Shamamian. (PO) This paper reports the civil engineering features and the solution of the related engineering problems resulting from the natural site conditions encountered as well as from those features developed to provide for the operating and building requirements of a modern plant of this capacity.

2132. Multipurpose Project Powerplant Capacity, by Richard E. Krueger. (PO) The major factors establishing the size of power plants attached to multipurpose irrigation projects of the Bureau of Reclamation are outlined here. Included are the basic factors to be considered in determining the number of units into which the plant is to be divided.

2133. Ocean Cooling Water Systems for Two Thermal Plants, by L. T. Mariner and W. A. Hunsucker. (PO) This paper compares varied problems associated with the design and construction of circulating water facilities for two coastal thermal plants to serve the City of Los Angeles. Widely differing locations pose diverse design problems of sanding, erosion, and navigational requirements.

2134. Freezing of Slurry Around Piles in Permafrost, by Ronald F. Scott. (SM) This paper presents an analysis of the problem involved in predicting the time that a slurry will take to freeze in particular conditions. The problem was solved by means of an electronic analog computer, and curves of the solution are presented.

2135. Compressibility as the Basis for Soil Bearing Value, by B. K. Hough. (SM) The value and practicability of rupture theory as the chief basis for bearing value determination is questioned. As an alternative it is proposed that contact pressures and footing sizes be selected so as to equalize settlement due to soil compression. Procedures for use in practical applications are proposed.

2136. Investigation of Underseepage—Mississippi River Levees, by W. J. Turnbull, and C. I. Mansur. (SM) In this paper, the influence of the geological make-up of the area on underseepage is demonstrated and theoretical aspects of the problem are considered. Piezometers are shown to be a practical field tool in developing data on the underseepage problem.

2137. Rock Characteristics at the Paulo Afonso Power Plant, by Ernesto Pechler and Francisco Barros. (SM) The Paulo Afonso Project on the Rio Sao Francisco is the first underground project in Brazil. Conduit system, power house and discharge are located wholly in rock. A number of tests have been carried out and valuable information about the behavior of the rock was obtained.

2138. Discussion of Proceedings Paper 1809, 1811, 1902, 1904, 1984, 1997. (HY) W. B. Langbein closure to 1809. W. B. Langbein closure to 1811. R. E. Hickson on 1902. David H. Miller on 1904. P. O. Wolf on 1984. T. R. Anand on 1997.

2139. Discussion on Proceedings Paper 1670, 1671, 1675, 1687, 1740, 1747, 1749. (PO) A. W. F. McQueen, C. N. Simpson and I. W. McCraig closure to 1670. J. Barry Cooke on 1671. C. M. Roberts on 1675. Paul Baumann closure to 1687. F. W. Patterson and D. H. MacDonald closure to 1740. Armondo da Palma Carlos on 1747. J. Barry Cooke on 1749.

2140. Discussion of Proceedings Paper 1654, 1655, 1727, 1728, 1730, 1826, 1864, 1937. (SM) T. William Lambe closure to 1654. T. William Lambe closure to 1655. Paul H. Shea and Harry E. Whitsett closure to 1727. K. Terzaghi and T. M. Leps closure to 1728. C. Martin Duke closure to 1730. Peter B. Heidema on 1826. F. L. Lawton on 1864. E. T. Hanrahan on 1937.

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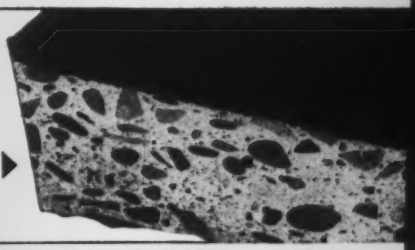
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In any such comparison, the superiority of LOCK JOINT CONCRETE PRESSURE PIPE is demonstrated by the experience of hundreds of municipalities. For example, records of one of the country's largest industrial cities indicate only minor maintenance or repair charges in the last 10 years against more than 18 million inch feet of LOCK JOINT CONCRETE PRESSURE PIPE in its water works system.

Your city, too, can virtually eliminate maintenance expense, and **save many times the initial installation cost with Lock Joint Concrete Pressure Pipe.**

LOCK JOINT PIPE CO.

East Orange, New Jersey

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